

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 October 2003 (02.10.2003)

PCT

(10) International Publication Number
WO 03/080481 A1

(51) International Patent Classification⁷: B65G 25/08,
25/10, B65F 3/14, B65B 13/20, 63/02

(21) International Application Number: PCT/AU03/00349

(22) International Filing Date: 21 March 2003 (21.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PS 1251 21 March 2002 (21.03.2002) AU

(71) Applicant (for all designated States except US): BYRNE
TRAILER MANUFACTURING (WAGGA WAGGA)
PTY LTD [AU/AU]; 278 Hammond Avenue, Wagga
Wagga, NSW 2650 (AU).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD,
SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US,
UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

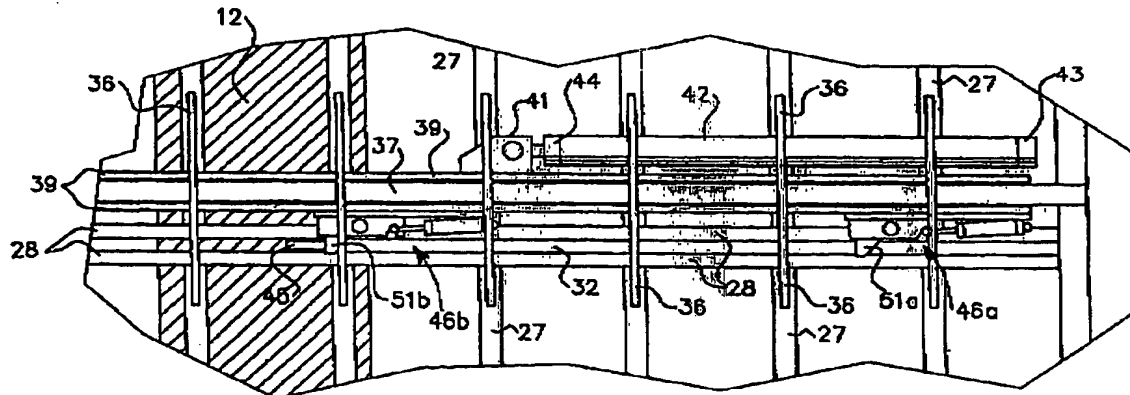
- with international search report
- with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(72) Inventor; and
(75) Inventor/Applicant (for US only): BYRNE, Laurence,
Michael [AU/AU]; 278 Hammond Avenue, Wagga Wagga,
NSW 2650 (AU).

(74) Agent: WALLINGTON-DUMMER; GPO Box 3888,
Sydney, NSW 2001 (AU).

(54) Title: INCREMENTAL MATERIAL URGING SYSTEM



(57) Abstract: An incremental material urging system comprising (a) a container structure (1) having a rear end and a forward end, (b) material urging structure (12) (c) material urging structure activating means (46) wherein said material urging structure is incrementally advanced from a retracted position at the rear end of said container structure, to a fully advanced position at the forward end of said container structure, where said forward end is a discharge end.

WO 03/080481 A1

INCREMENTAL MATERIAL URGING SYSTEM

The present invention relates to systems for the incremental conveying of solid material for transfer
5 between adjacent locations and for the incremental compaction of loose polymorphous material for the purposes of minimizing costs of storage, transportation or disposal.

BACKGROUND

10 Compaction of loose material is desirable in many industries and for many different reasons. Generally the process includes some form of a confining volume into which the material is deposited with a subsequent mechanical means of decreasing that volume.

15 In a particular application, that of waste management, the confining volume may take the form of an elongate generally rectangular section container having a moveable urging structure at one end. Waste matter is introduced into the container following which hydraulic rams cause the
20 urging structure to be moved along a part of the length of the container, driving the material into a compacted mass against a discharge gate. Once compacted, the mass may be ejected from the forward end of the container structure by a further movement of the rams, for example into a
25 transport vehicle.

- 2 -

A feature of such compaction systems is the need for very long hydraulic rams. These then have to be of telescopic multi stage construction and of large diameter to ensure sufficient power towards the end of the compaction stroke, where the load tends to a maximum. These requirements in turn demand very large hydraulic power systems making compactors of this type very expensive and generally beyond the reach of small isolated communities.

Generally the discharge of the compacted material is into a transport vehicle for subsequent transfer to a waste disposal or recycling site at which point the material has to be removed from the transport vehicle.

One known method is that of hydraulically jacking the container portion of the vehicle to a sufficient angle to allow the material to be ejected under the force of gravity. Particularly at soft surface land-fill sites this entails a danger of the vehicle tipping over side-ways as its center of gravity is raised during the jacking process.

Another known method is by means of a so-called walking floor fitted to the vehicle in which a series of hydraulically articulated rails cover the floor of the vehicle. These are bulky, very complex, expensive and heavy devices with high wear rates and maintenance costs, adding significantly to the cost of waste management.

In general the conveying of solid material or objects into and out of a transport vehicle is generally a time consuming operation often involving piecemeal retrieval of one object at a time from its pre-loading position to a position in the transport vehicle. Particularly in the case of palletized materials, the usual method is by means of a fork-truck or similar equipment. This imposes limitations on the type of vehicle which can be used, generally requiring a vehicle with side-loading capability. This requires considerable adjacent space, which may be a scarce and expensive commodity at city loading docks for example.

It is an object of the present invention to address or ameliorate at least one of the above disadvantages.

15 BRIEF DESCRIPTION OF INVENTION

Accordingly, in one broad form of the invention there is provided an incremental material urging system comprising:

- 20 (a) a container structure having a rear end and a forward end,
- (b) a material urging structure
- (c) material urging structure activating means wherein said material urging structure is incrementally advanced from a retracted position

at said rear end of said container structure, to a fully advanced position at said forward end of said container structure, where said forward end is a discharge end.

5 Preferably said container structure includes;

- (a) a floor sub-structure
- (b) side wall sub-structures
- (c) a roof
- (d) a top opening
- 10 (e) a top opening cover
- (f) a discharge end closure means

Preferably said material urging structure is incrementally retracted by said activating means from said discharge end to said rear end of said container structure,

15 Preferably said activating means are disposed along each side wall of said container structure and wherein said activating means operate substantially in unison.

Preferably the material urging structure is a close sliding fit within said container structure, said material
20 urging structure adapted to slide on the surface of said floor sub-structure.

Preferably each of said side wall substructures is provided with a slot extending substantially along the length of said wall substructure, said slot providing a

separation between an upper and a lower portion of internal wall sheeting.

Preferably said material urging structure is provided on each side of said structure with a projecting lug, each
5 one of said lugs projecting through one of said slots.

Preferably each of said slots is co-linear with a rail system said rail system adapted to support and guide a reciprocating beam.

Preferably said reciprocating beam is provided with a
10 plurality of thrust assemblies, said thrust assemblies disposed at substantially equal intervals along the length of said beam, between a forward end and a rear end of said beam.

Preferably each of said thrust assemblies includes;

- 15
- (a) an assembly support
 - (b) a double ended pawl
 - (c) a pawl pivot shaft
 - (d) a pawl actuator means

Preferably said double ended pawl is rotatable about
20 said pawl pivot shaft by said pawl actuator means from a first forward thrusting position to a second rearward thrusting position.

Preferably said pawl actuator means is a linear actuator.

Preferably each of said double ended pawls is rotated by a linear actuator; said actuator pivotally connected at a first end to one end of said double ended pawls and at a second end to said reciprocating beam.

- 5 Preferably each of said double ended pawls is provided with a pawl control bracket, said bracket supporting a control pivot shaft.

Preferably each of said control pivot shafts is pivotally connected to a common control arm, said control
10 arm being pivotally connected at an outer end to a linear actuator and wherein said actuator is pivotally connected to said reciprocating beam.

Preferably each one of said double ended pawls is adapted to thrust against the rearward facing side of said
15 projecting lug when said double ended pawl is in said forward thrusting position and to thrust against the forward facing side of said projecting lug when said double ended pawl is in a rearward thrusting position.

Preferably that portion of a first pawl of said double
20 ended pawls adapted to thrust against said projecting lug presents a vertical outer surface when set in said thrusting position; the second pawl then rotated to a position precluding potential contact with said projecting lug.

- 7 -

Preferably the opposite face of each of said pawls of said double ended pawls is a sloping face, said sloping faces intersecting on the bisector of the double ended pawls so as to form a shallow "V" shaped space and where
5 the sloping opposite face of that pawl set to a thrusting position is adapted to impart a turning moment to said pawls when impacting on said projecting lug while said pawl actuator is deactivated.

Preferably said double ended pawls may be rotated when
10 impacted by a said sloping face to a position about said pivot shaft such that said projecting lug is able to pass said thrust assembly.

Preferably said reciprocating beam is urged into reciprocating motion by an hydraulic ram pivotally
15 connected at a first end of said ram to said reciprocating beam and at a second end of said ram to said container structure.

Preferably said reciprocating beam is fitted at its forward outer end with an initial retraction thrust block
20 and at its rear outer end with an initial advance thrust block.

Preferably when said material urging structure is in a fully retracted first position at said rear end of said container structure and said hydraulic ram is retracted,

- 8 -

said projecting lug is located between said initial advance thrust block and the first thrust assembly located nearest said rear end of said reciprocating beam.

Preferably the sequence of said material urging structure activating means for a first forward movement of
5 said material urging structure comprises the steps of:

- 10 (a) extending said hydraulic ram to urge said initial advance thrust block into contact with said projecting lug so as to drive said lug and said material urging structure to a first partial forward incremented position,
- (b) retracting said pawl control actuator to rotate said double ended pawl into a forward thrust position,
- 15 (c) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said forward thrust position is contacted by said projecting lug,
- 20 (d) retracting said hydraulic ram so as to retract said thrust assembly nearest to rear end of said reciprocating beam past said projecting lug,
- (e) retracting said pawl control actuator to reset said double ended pawls of said thrust assembly

- 9 -

nearest to rear end of said reciprocating beam to said forward thrust position,

- 5 (f) extending said hydraulic ram to drive said thrust assembly nearest to rear end of said reciprocating beam into contact with said projecting lug thereby driving said material urging structure to a completed first forward increment.

10 Preferably subsequent forward increments of said material urging structure comprise the steps of:

- (a) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when contacted by said projecting lug,

- 15 (b) retracting said hydraulic ram so as to retract the next forward thrust assembly past said projecting lug,

- (c) retracting said pawl control actuator to reset the next forward thrust assembly to said forward thrust position,

- 20 (d) extending said hydraulic ram to drive forward said next forward thrust assembly thereby driving said material urging structure to a next forward incremented position.

- 10 -

Preferably, when said material urging structure is in a fully advanced position at said forward end of said container structure and said hydraulic ram is extended, said projecting lug is located between said initial retract thrust block and the thrust assembly located nearest said forward end of said reciprocating beam.

Preferably the sequence for a first rearward movement of said material urging structure comprises the steps of:

- (a) retracting said hydraulic ram to urge said initial retract thrust block into contact with said projecting lug thereby driving said lug and said material urging structure to a first partial rearward incremented position,
- (b) extending said pawl control actuator to rotate said double ended pawl into a rearward thrust position,
- (c) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said rearward thrust position is contacted by said projecting lug,
- (d) extending said hydraulic ram so as to advance said thrust assembly nearest to forward end of said reciprocating beam past said projecting lug,

- 11 -

- (e) extending said pawl control actuator to reset said double ended pawls of said thrust assembly nearest to rear end of said reciprocating beam to said rearward thrust position,

5 Preferably subsequent rearward increments of said material urging structure comprise the steps of:

- (a) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when contacted by said projecting lug,
- 10 (b) extending said hydraulic ram so as to advance the next rearward thrust assembly past said projecting lug,
- (c) extending said pawl control actuator to reset the next rearward thrust assembly to said rearward thrust position,
- 15 (d) retracting said hydraulic ram to drive rearward said next rearward thrust assembly thereby driving said material urging structure to a next rearward incremented position.

20 Preferably said urging system is adapted to the compaction of refuse.

Preferably said roof is provided with an openable aperture for the introduction of refuse into said container structure.

- 12 -

Preferably said closure means is in the form of a discharge gate, said gate adapted to provide a reaction surface for the compaction of said refuse between said discharge gate and said material urging structure.

5 Preferably said container structure is provided with an intermediate openable gate positioned between said discharge gate and said openable aperture in said roof, said intermediate gate adapted to provide a reaction surface for the compaction of refuse between said
10 intermediate gate and said material urging structure.

Preferably said container structure is provided with a plurality of articulated compaction devices; said devices supported by hinges along said sides of said container structure; said devices acting through apertures in said
15 sides to intrude into a volume of refuse contained in said container structure.

Preferably said articulated compaction devices are hinged from said roof of said container structure; said compaction devices acting through apertures in said roof.

20 Preferably said container structure is provided with at least one articulated section of said floor; said floor section adapted to rise vertically within said container structure to provide compaction force on a volume of refuse.

- 13 -

Preferably said container structure is provided with at least one articulated section of said roof; said roof section adapted to descend vertically within said container structure to provide compaction force on a volume of refuse.

Preferably said urging system is adapted to the transfer of a compacted volume of refuse from said container structure into a transport vehicle.

Preferably said system is adapted to the retrofitting of said system to existing refuse transfer stations.

Preferably said system is adapted to the reduction in volume of any compactable material.

Preferably said system is adapted to the discharge of material from a transport vehicle, the load container of said vehicle forming a container structure.

In a further broad form of the invention there is provided an incremental material urging system comprising;

- (a) a floor structure,
- (b) at least a pair of guide elements extending in spaced apart parallel configuration along a portion of said floor structure,
- (c) a material urging structure adapted to incremental movement along said guide elements, said urging structure provided with a load urging

- 14 -

surface normal to said floor structure and transverse to said guide elements,

(d) a material urging structure incrementing means.

Preferably said material urging structure includes a substantially vertical surface adapted to act against moveable load objects.

Preferably said urging structure incrementing means include:

(a) at least one linear actuator,

(b) a guide element clamping mechanism associated with each said linear actuator.

Preferably said linear actuator is attached at a first end to a rear portion of said urging structure and at a second end to a said rail clamping mechanism; said linear actuator lying substantially in the vertical plane through said guide element.

Preferably said clamping mechanism comprises a clamping caliper provided with gripping pads adapted to apply frictional force to each side of said guide element.

Preferably said linear actuator is an hydraulic ram.

Preferably said clamping caliper is activated by an hydraulic ram.

- 15 -

Preferably an increment of said urging structure for the purpose of advancing said load objects along said floor structure is effected by the steps of:

- (a) extension of said linear actuator while said
5 clamping mechanism is activated to grip said guide element,
- (b) deactivating said clamping mechanism,
- (c) retracting said linear actuator.

Preferably an increment of said urging structure for
10 the purpose of retracting said urging structure is effected by the steps of:

- (a) retraction of said linear actuator while said
clamping mechanism is activated to grip said
guide element,
- 15 (b) deactivating said clamping mechanism,
- (c) extending said linear actuator.

Preferably said guide element is a rail.

Preferably said guide element is a channel let into
said floor structure.

20 In yet a further broad form of the invention there is provided an incremental material urging system comprising;

- (a) a floor structure,

- 16 -

- (b) at least a pair of rail elements extending in spaced apart parallel configuration along a portion of said floor structure,
- (c) a yoke providing a transverse linking of said rail elements at one end of said rail elements,
- (d) a linear actuator linked to said yoke, the axis of said actuator disposed in parallel alignment to said rail elements, said actuator adapted to urge reciprocating movement of said rail elements along said floor,
- (e) a material urging structure adapted to incremental movement along said rail elements, said urging structure provided with a vertical load urging surface normal to said floor structure and transverse to said rail elements,
- (f) urging structure clamping elements, said elements adapted to releasably lock said urging structure to said rail elements.

Preferably said material urging structure is supported on said rail elements by friction reducing means.

Preferably said material urging structure is supported by said floor structure by friction reducing means.

Preferably said floor structure is provided with material urging structure arresting means.

- 17 -

Preferably said arresting means are comprised of a plurality of vertical articulated pins disposed in pairs transverse to said rail elements and at intervals along the length of said rail elements equivalent to the stroke
5 length of said actuator, said pins adapted to move between a first retracted position flush with said floor and a second extended position projecting from said floor.

Preferably said material urging structure is provided with friction pads, said pads adapted to be driven
10 downwardly relative to said urging structure so as to provide friction sufficient to arrest said structure at an incremented position.

In yet a further broad form of the invention there is provided a method for the compaction and transfer to a
15 refuse transport means of a volume of refuse, said method including the steps of:-

- (a) loading a quantity of refuse material through an opening in the roof of a container structure, said container structure provided with an
20 incrementing material urging structure and an openable discharge gate,
- (b) closing said opening so as to provide a sealed container envelope for said quantity of refuse,

- 18 -

- (c) incrementally advancing said urging structure to a desired degree of compaction of said refuse material,
- (d) aligning the loading aperture of a refuse transport means with said discharge gate of said container structure,
- (e) opening of said discharge gate and incrementing said material urging structure so as to discharge said refuse material into said refuse transport means.

In yet a further broad form of the invention there is provided a method for the removal of material from the container structure of a transport vehicle, said method including the steps of:-

- (a) providing said container structure with a material urging structure, said structure provided with a load urging surface having an area equivalent to the internal cross-section of said container structure,
- (b) activating said container structure with reciprocating mechanisms adapted to increment said urging structure between a first retracted end to a second discharge end.

- 19 -

In yet a further broad form of the invention there is provided an incremental compaction system comprising:

- (a) an elongate rectangular section container structure
- 5 (b) a compactor blade structure
- (c) a compactor blade structure activating means wherein said compactor blade structure is incrementally advanced from a retracted position at a first end of said container structure, to a
10 fully advanced position at a second end of said container structure, where said second end is a discharge end.

Preferably said compactor blade structure is incrementally retracted from said second end to said first
15 end of said container structure.

Preferably said container structure includes;

- (a) floor sub-structure
- (b) wall sub-structures
- (c) roof
- 20 (d) top opening
- (e) top opening cover
- (f) discharge gate

Preferably the compactor blade structure is a close sliding fit within said container structure, said compactor

- 20 -

blade structure adapted to slide on the surface of said floor sub-structure.

Preferably said wall sub-structures include vertical and horizontal frame members.

5 Preferably said wall sub-structures include wall sheeting supported internally on said frame members.

Preferably said wall sheeting is arranged in a substantially equal upper portion and substantially equal lower portion, said upper and lower portions being
10 separated so as to form a horizontal slot between the bottom edge of said upper portion and the top edge of said lower portion.

Preferably the outside edges adjoining said slot between said upper portion and said lower portion of said
15 wall sheeting, are supported by horizontal frame members.

Preferably said vertical frame members and horizontal frame members of said wall sub-structure are combined to form an upper frame structure and a lower frame structure adapted to support said upper portion and said lower
20 portion of said wall sheeting.

Preferably the vertical frame members of said upper frame structure and said lower frame structure are rigidly joined together by outwardly arching frame joining webs.

- 21 -

Preferably two longitudinal rail members are disposed side by side between said upper frame structure and the inside of said frame joining webs, the first of said longitudinal rail member being fixed to said frame structure and the second of said longitudinal rail member being fixed to said frame joining webs so as to form a vertical slot between adjoining sides of said rail members.

Preferably said longitudinal rail members are square or rectangular section steel tubing.

10 Preferably the upper, lower and opposing surfaces of said longitudinal rail members are provided with bearing strip material.

Preferably said longitudinal rail members and said bearing strip material slidably support and guide the inside surfaces of an I-beam, oriented such that the central web of said I-beam hangs between said longitudinal rail members.

Preferably said I-beam is provided with a plurality of thrust assemblies attached at substantially equal intervals along the underside of the lower cross piece of said I-beam.

Preferably each of said thrust assemblies includes;

- (a) an assembly housing
- (b) a double ended pawl

- 22 -

(c) a pawl pivot shaft

(d) a pawl actuator means

Preferably said housing is a substantially rectangular box-shaped structure open at its underside with said pawl
5 pivot shaft supported in apertures in two opposite sides of said housing.

Preferably said double ended pawl is retained on said pivot shaft within said assembly housing such that in a first position of said pawl, a first end of the pawl
10 projects from the underside of said housing and in a second position the second end of the pawl projects from the underside of said housing.

Preferably said first position of said pawl is urged by a first operating mode of said pawl actuator means and
15 said second position of said pawl is urged by a second operating mode of said pawl actuator means.

Preferably said pawl actuator means is a pneumatic cylinder.

Preferably said pawl actuator means is an hydraulic
20 cylinder.

Preferably said first end of said pawl presents a vertical outer face towards the discharge end of said container structure, when projecting from below said housing and an opposing upwardly sloping face towards the

- 23 -

axis of said pivot shaft when said pawl is in said first position.

Preferably said second end of said pawl presents a vertical outer face towards said first end of said container structure when projecting from below said housing and an opposing upwardly sloping face towards the axis of said pivot shaft when said pawl is in said second position.

Preferably said wall sub-structures and all elements attached thereto are symmetrical for both sides of the compaction system.

Preferably said compactor blade structure activating means are two horizontally disposed hydraulic rams mounted at their passive ends to each of said side wall sub-structures and at their rod ends to thrust blocks attached to each of said I-beams.

Preferably said I-beams are urged into reciprocal horizontal motion relative to said longitudinal rail system by said hydraulic rams.

Preferably said compactor blade structure is provided with a projecting lug on each of its sides, said projecting lug adapted to pass through the slot between upper and lower portions of wall sheeting.

Preferably said lugs are adapted to contact said vertical faces of any one of said double ended pawls of

- 24 -

said thrust assemblies on each side of the container structure.

Preferably said edges of said lugs facing said first end of said container structure are brought into contact with said vertical face of a pawl of one of corresponding said thrust assemblies on each side of said container structure when said pawl is in said first position, by the extending action of said hydraulic rams.

Preferably said edges of said lugs facing said second end of said container structure are brought into contact with said vertical face of a pawl of one of corresponding said thrust assemblies on each side of said container structure when said pawl is in said second position, by the retracting action of said hydraulic rams.

Preferably said upwardly sloping face of said pawl, when forced into contact with an edge of said lug of said compactor blade structure, causes said pawl to rotate about said pawl pivot axis thereby allowing the thrust assembly of that pawl to pass said lug.

Preferably said pawl actuation means of a said thrust assembly is set to a non-operating mode when any said thrust assembly is required to pass said lug.

Preferably a first extending action of said hydraulic rams, when said pawls are in said first position and said

- 25 -

compactor blade structure is in a fully retracted position, will cause pawls of the corresponding pair, one on each side of said container structure, of said thrust assemblies closest to said first end of said container structure, to
5 force said compactor blade structure towards said discharge end in a first incremental movement.

Preferably a first retraction movement of said hydraulic rams following a first extension movement of said rams, causes the next closest corresponding pair of thrust
10 assemblies, one on each side of said container structure, to pass over said lug of said compactor blade structure, the pawls of said thrust assemblies rotating into said thrust assembly housings from forced contact between said lug and upwardly sloping faces of said pawls.

15 Preferably pawls of the next closest corresponding pair of said thrust assemblies to said first end of said container structure, are urged into a said first position by said pawl actuator means.

Preferably a second extension of said hydraulic rams
20 causes a second incremental movement of said compactor blade structure towards said second end of said container structure.

Preferably subsequent extensions and retractions of said hydraulic rams cause corresponding incremental

- 26 -

movements of said compactor blade towards said second end of said container structure, said movements ending after engagement of the pawls of that pair of corresponding connector housings closest to said second end of said container structure, and the extending of said hydraulic rams.

Preferably extending strokes of said hydraulic rams for incremental movement of said compactor blade structure are smaller than the maximum stroke of said rams.

10 Preferably the last incremental movement of said compactor blade structure causes said blade structure to partially project from said second end of said container structure.

15 Preferably a first incremental retracting movement of said compactor blade structure from its said limit of travel at said second end of said container structure, is preceded by an extension of said hydraulic rams to the maximum stroke of said rams.

20 Preferably any incremental retracting movement of said compactor blade structure is preceded by an urging of said second ends of double ended pawls into said second position by said pawl actuator means.

Preferably said edges of said lugs facing said second end of said container structure are brought into contact

- 27 -

with said vertical faces of a pawls of corresponding pairs of said thrust assemblies, one on each side of said container structure when said pawl is in said second position, by the retracting action of said hydraulic rams.

5 Preferably a first retraction movement of said hydraulic rams, when said pawls are in said second position and said compactor blade structure is in a final incremented position at said second end of said container structure, will cause pawls of the corresponding pair, one
10 on each side of said container structure, of said thrust assemblies closest to said second end of said container structure, to force said compactor blade structure towards said first end of said container structure, in a first incremental movement.

15 Preferably a first extension movement of said hydraulic rams following a first retraction movement of said rams, causes the next closest corresponding pair of thrust assemblies, one on each side of said container structure, to pass over said lug of said compactor blade
20 structure, the pawls of said thrust assemblies rotating into said thrust assembly housings from forced contact between said lug and upwardly sloping faces of said pawls.

Preferably subsequent retractions and extensions of said hydraulic rams cause corresponding incremental

- 28 -

movements of said compactor blade towards said first end of said container structure, said movements ending after engagement of the pawls of that pair of corresponding connector housings closest to said first end of said container structure, and the retraction of said hydraulic rams.

Preferably retracting strokes of said hydraulic rams for incremental movement of said compactor blade structure to the limit of its travel at said first end of said container structure are smaller than the maximum stroke of said rams.

Preferably said discharge gate is adapted to provide one end of a compaction space defined by said gate, walls, roof and floor of said container structure and with an opposite end provided by the front face of said compactor blade structure.

Preferably said discharge gate is hydraulically operable.

Preferably said top opening is an opening in the roof of said container structure, said opening adapted to receive compactable material.

Preferably said top opening cover is hydraulically operable.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described with reference to the accompanying drawings wherein:

5 Figure 1 is a general perspective view of the first and second preferred embodiments of the invention,

Figure 2a and 2b show a first and second embodiment of the invention in use,

10 Figure 3 is a cross-section view of a side wall substructure according to the first preferred embodiment of the invention,

Figure 4 is a side view of the side wall substructure of Figure 3,

15 Figures 5a to 5c show a first operating sequence of a component of part of the first preferred embodiment of the invention,

Figures 6a to 6c show a second operating sequence of the component of Figures 5a to 5c,

20 Figure 7 is a cross-section view of a side wall substructure according to the second preferred embodiment of the invention,

Figures 8a to 8c show a first operating sequence of a component part of the embodiment of Figure 7,

- 30 -

Figures 9a to 9c show a second operating sequence of a component part of the embodiment of Figure 7,

Figures 10a and 10c show a third operating sequence of a component part of the embodiment of Figure 7,

5 Figure 11 is a perspective view of a third embodiment of the invention,

Figure 12 is a perspective view of a fifth preferred embodiment of the invention,

10 Figure 13 is a perspective view of a sixth preferred embodiment of the invention,

Figure 14 is a perspective view of a sixth preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

15 First Embodiment

A first preferred embodiment of the invention will now be described with reference to the accompanying drawings in which a material urging system is adapted to the compaction
20 of loose material.

With reference to the perspective view of Figure 1 a material urging system 10 comprises a container structure 11 including floor substructure 15, wall substructures 16, a discharge gate 21 and material urging structure 12. Roof
25 17 includes top opening 18 and top opening cover 19.

- 31 -

Preferably top opening cover 19 and discharge gate 21 are operated by hydraulic rams 20 and 23 respectively.

Figure 1 shows material urging structure 12 in its fully advanced position projecting through discharge gate opening 22 with discharge gate 21 in its open position. When material urging structure 12 is in a fully retracted position at rear end 13 of container structure 11, compactable material may be inserted into the container through top opening 18. With the top opening cover 19 closed and discharge gate 21 lowered, material urging structure 12 is driven towards the forward end 14, thereby compacting any material in the container against the discharge gate 21.

Figure 2a shows material urging system 10 in loading mode, with side wall substructure and part of internal wall sheeting removed for clarity, and where material urging structure 12 is fully retracted at rear end 13 of container structure 11 and compactable material 24 is introduced through top opening 18.

Figure 2b shows material urging system 10 with side wall substructure 16 removed for clarity, and where compacted material 25 has been ejected through opened discharge gate 21 into transport vehicle 26.

- 32 -

The process of compaction of compactable material according to this first embodiment of the invention will now be described in more detail.

Figure 3 is a cross section of a wall substructure 16 as viewed from the forward end 14 of container structure 11. It should be noted that the wall substructure 16 and all associated components shown in Figures 3 and 4 are symmetrically duplicated for the opposite side wall of container structure 11 and the mechanism hereinafter described works in unison on both sides of the container structure.

Wall substructure 16 includes upper frame structure 34 and lower frame structure 35 made up of a plurality of vertical frame members 27 and horizontal frame members 28 (as further illustrated in Figure 4). Affixed internally to upper frame structure 34 and lower frame structure 35 are upper wall sheeting portion 30 and lower wall sheeting portion 31 respectively.

The upper and lower portions of wall sheeting 30 and 31 and frame structures 34 and 35, are separated so as to form a horizontal slot 32 extending substantially for the length of the container structure 11. Joining webs 36 are rigidly connected to each corresponding upper and lower vertical frame member 27 to effectively combine upper and

- 33 -

lower frame structures 34 and 35 into a unified rigid structure.

Still with reference to Figure 3, a pair of longitudinal rail members 37 disposed side by side are provided of which the inner rail member is attached to upper wall section vertical frame members 27 and the outer rail member is attached to the joining webs 36. Rail members 37 are spaced apart so as to leave a vertical slot 40 between their adjoining sides. Rail members 37 extend the length of container structure 11 and are preferably in the form of rectangular section steel tubing. The upper, lower and adjoining surfaces of longitudinal rail members 37 are provided with bearing strip material 38.

Interposed between adjoining longitudinal rails 37 is an I-beam 39 oriented so that its central web hangs vertically in slot 40 with the underside surfaces of its upper flange supported on the bearing strip material 38 covering the upper surfaces of longitudinal rail members 37. The sizes of rail members 37, I-beam 39 and bearing strip material 38 are so chosen as to allow a sliding fit reciprocating movement of I-beam 39 on rails and bearing strips.

Attached to the upper flange of I-beam 39 is thrust block 41. A main hydraulic ram 42, attached to wall

- 34 -

substructure 16 at the ram's passive end 43, and to thrust block 41 at its rod end 44, is adapted to impart the reciprocating movement to I-beam 39.

Attached to the lower flange of I-beam 39 is a plurality of thrust assemblies 46a to 46n. Each thrust assembly 46 includes a double ended pawl 48 of which a first end 51 is visible in Figure 3. Pawl 48 is mounted on pivot shaft 50 supported in thrust assembly support 47 and may be rotated about pivot shaft 50 by pawl actuator means 49 so as to bring one of its ends down to the level of slot 32; its other end then having been rotated into a position above and clear of the level of slot 32.

Material urging structure 12 is adapted to slide on floor 15 and is a close sliding fit between internal wall sheeting 29 and roof 17. Each side of material urging structure 12 is provided with projecting lug 45, adapted to extend through slot 32 so as to engage with one end of double ended pawl 48.

Figure 4 shows a side view of material urging system 10 from which the internal wall sheeting has been omitted for clarity.

Material urging structure 12 shown as hatched, has been moved towards the discharge gate 21 of container structure 11 to the position shown, by a first extension

- 35 -

stroke of hydraulic ram 42 acting on I-beam 39. First movement of I-beam 39 was transferred to projecting lug 45 through pawl first end 51a of thrust assembly 46a. As shown in Figure 4, main ram 42 is in its retracted state ready to move material urging structure 12 a second increment towards the discharge gate by driving pawl end 51b of thrust assembly 46b against projecting lug 45.

The interaction of material urging structure 12 projecting lug 45 and a thrust assembly 46 will now be described in detail with reference to Figures 4 and 5a to 5d. Again it should be noted that the actions described are symmetrically duplicated for both sides of container structure 11.

At the start of a compaction sequence, material urging structure 12 is fully in its retracted position at rear end 13 of container structure 11 (Figure 4). As shown in Figure 5a, projecting lug 45 is then forward, (that is towards the forward end 14), of thrust assembly 46a. At this stage, thrust assembly pawl actuator 49a is in retracted mode which has rotated first end 51a of pawl 48a in forward thrust position. Main ram 42 now extends for a first compaction stroke, sliding I-beam 39 forward together with thrust assembly 46a, to force lug 45 and hence material urging structure forward to a first incremented position.

- 36 -

Hydraulic ram 42 now retracts, to pull I-beam 39 back to its initial position. This requires second thrust assembly 46b to pass the projecting lug 45 as shown in Figure 5b and 5c. This is achieved by de-activating pawl actuator 49b, allowing double ended pawl 48b to rotate about pawl pivot shaft 50b as upwardly sloping face 56b is forced against the lug 45. When ram 42 is fully retracted, pawl actuator 49b is returned to its retracted position, thus rotating first end 51b of pawl 48b to its forward thrust position as shown in Figure 5d.

This sequence is repeated until material urging structure 12 reaches a point of maximum or desired compaction. Discharge gate 21 is then opened and the compacted material incrementally advanced until material urging structure 12 reaches its forward limit at forward end 14 of container structure 11, projecting through opened discharge gate 21.

Depending on the material being compacted, the material urging structure 12 may be subject to a degree of "spring-back", especially as maximum compaction is approached towards the end of the compaction process. This can force the urging structure back into a position where the next thrust assembly cannot be retracted back past the projecting lug and hence no further incremental movement of

- 37 -

the urging structure is possible. To prevent this situation, material urging structure 12 may be fitted with braking or locking means which are activated during the retraction of I-beam 39 and until the double ended pawls
5 are returned to the forward thrust position.

For the incremental movements towards forward end 14, main ram 42 does not out-stroke to its full extent, the stroke being controlled by suitable limit switches. This is to allow the furthest forward thrust assembly 46n to be
10 driven just past lug 45, (when second end 52n has been rotated to its reverse thrust position and its actuator is de-activated), by a full extension of the main ram 42. After extending pawl actuator 49n to reset second end 52n to the reverse thrust position, the first return increment
15 of material urging structure 12 towards rear end 13 of container structure 11 may be made.

This process is shown in Figures 6a to 6c. Initially I-beam 39 with thrust assembly 46n is partially retracted by main ram 42 to allow pawl actuator 49n to extend,
20 thereby rotating pawl 48n to bring second end 52n of pawl 48n into its reverse thrust position as shown in Figure 6a.

With pawl actuator 49n de-activated, thrust assembly 46n is pushed past lug 45 by the full extension of main ram 42 as shown in Figure 6b. Pawl actuator 49n now extends to

- 38 -

reset second end 52n to its reverse thrust position as shown in Figure 6c. Retraction of main ram 42 now forces material urging structure 12 into a first retracted position. Extension of main ram 42, (while pawl actuator 5 49n-1 is de-activated), allows thrust assembly 46n-1 to be pushed past lug 45. After second end 52n-1 of pawl 48n-1 has been set to its reverse thrust position, the next retraction of ram 42 forces the material urging structure 12 into a second retracted position.

10 This sequence is repeated until the material urging structure 12 is returned to its fully retracted position at rear end 13 of container housing 11. The retraction strokes of main ram 42 for the incremental retraction of material urging structure 12 are shorter than the full retraction 15 stroke of main ram 42, the stroke being limited by suitable limit switches. This is to allow the first thrust assembly 46a to be retracted past lug 45 by a full retraction of the ram to re-commence the incremental compaction sequence described above.

20 In use, the incremental advance of the material urging structure towards the forward end of container structure 11, occurs once a quantity of compactable material has been introduced into container structure 11 and both the top opening cover 19 and discharge gate 21 are closed. When a

- 39 -

desired degree of compaction has been achieved at some point during the advance of material urging structure 12, discharge gate 21 is opened and the compacted material ejected by the completion of the incremental advance of the
5 urging structure.

As an aid to the compaction process, an optional intermediate compaction gate may be located at some point between the top opening and the discharge gate. This allows smaller quantities of refuse material to be compacted and,
10 once compacted, to be pushed past the intermediate gate. This has the advantage of achieving a higher compaction density of the final compacted load available for transfer to the refuse transport vehicle.

Second Embodiment

15 In a second preferred embodiment of the invention, the construction of the container structure is as that previously described for the First Embodiment above and, as before, both sides of the container structure are symmetrical and carry symmetrical mechanical systems. Like
20 features are numbered as for the first embodiment but with the addition of 100 so that for example feature 39 is number 139 in this embodiment and so forth.

With reference to Figure 7 I-beam 139 is supported by twin longitudinal rail members 137 and is connected to main

- 40 -

hydraulic ram 142 via thrust block 141. Attached at intervals along the underside of I-beam 139 are thrust assemblies 146, the end view of one of which, as seen from the forward end of the container structure 111, is shown in Figure 7. In this embodiment thrust assembly 146 is comprised of clevis mount 160 carrying pawl pivot shaft 150 about which rotates double ended pawl 148. Rigidly connected to pawl 148 as may best be seen in Figure 8a, is control bracket 161 which in turn carries control pivot shaft 162. Again with reference to Figure 8a, control pivot shaft 162 is pivotally connected by means of bearing 163 to control arm 164.

Control arm 164 similarly connects to each of the control pivot shafts 162 of each of the thrust assemblies 146 whereby reciprocating movements of control arm 164 have the effect of rotating the attitude of double ended pawls 148 between a forwardly incrementing thrust position as in Figure 8a and a rearwardly incrementing thrust position as in Figure 8c.

Control arm 164 is connected to a pawl control actuator 166 (shown in Figure 10a), such as an hydraulic ram, mounted to I-beam 139 at rear end 113 of container structure 111, so that by the operation of this single

- 41 -

actuator, the operating positions of all double ended pawls may be changed in unison.

Intermediate incrementing of material urging structure

5 With reference to Figure 8a, at the beginning of an intermediate increment of the material urging structure 112 towards the forward end 114 of container structure 111, the pawl control actuator is in its retracted position so that control arm 164 has rotated all double ended pawls 148 into
10 the forwardly incrementing thrust position as shown in Figure 8a. I-beam 139 is now urged towards forward end 114 by the extending of main ram 142.

 This brings first end 151(i) of pawls 148(i) of that thrust assembly 146(i) which is closest to projecting lug
15 145 of the material urging structure 112 (represented in Figures 8a to 8c by a dashed line) into contact with projecting lug 145, thereby driving the material urging structure forward towards forward end 114. Thus in Figure 8a, it is first end 151(i) of double pawl 148(i) of thrust
20 assembly 146(i) which has contacted projecting lug 145 and drives material urging structure 112.

 When this stroke of I-beam 139 has reached its limit, pressure is released from the pawl control actuator and I-beam 139 is retracted by hydraulic ram 142. Towards the end

- 42 -

of this retraction stroke, the next forward thrust assembly 146(i+1) to assembly 146i just used to drive the material urging structure forward, has to pass the projecting lug 145. This situation is shown in Figure 8b, (in which the control bracket 161(i+1) and control arm 164 have been partly removed for clarity) where thrust assembly 146(i+1) has reached projecting lug 145. As thrust assembly 146_{i+1} continues to be retracted, double ended pawl 148(i+1) is forced to rotate about pawl pivot shaft 150(i+1) as the upwardly sloping face 156(i+1) is forced against projecting lug 145.

This rotation continues until first end 151(i+1) of double ended pawl 148(i+1) slides over the top of projecting lug 145 as shown in Figure 8c. At the limit of retraction of I-beam 139, double ended pawl 148(i+1) (together with all double ended pawls of the thrust assemblies) is rotated back into the forward thrust position of Figure 8a by the retraction of the pawl control actuator.

This sequence is repeated until material urging structure 112 reaches a point of maximum or desired compaction. Discharge gate 21 is then opened and the compacted material incrementally advanced until the material urging structure reaches its forward limit at

- 43 -

forward end 114 of container structure 111, projecting through opened discharge gate 121.

To prevent "spring-back" of the material urging structure 112 induced by the compacted material driven before it, urging structure 112 may preferably be fitted with braking or locking means to retain its incremented position while thrust assemblies are being retracted for a next forward increment.

10 First return increment

The final forward incremental stroke of the main rams drives the material urging structure through the discharge gate sufficiently far to completely push the compacted material into the adjoining transport vehicle as shown in Figure 2b. At this point the furthest forward thrust assembly 146n which has moved the urging structure to this final discharge position remains behind the projecting lug 145 of the urging structure. To make the initial incremental return of the urging structure, a return thrust block 165 is attached to the end of I-beam 139 just forward of the furthest forward thrust assembly 146n as shown in Figure 9a.

When I-beam 139 is retracted, thrust return block 165 acts on projecting lug 145 and material urging structure

- 44 -

112 is moved a first partial return increment towards the rear end 113 of container structure 111. The pawl control actuator now extends to rotate double ended pawls 148n into their return thrust position as shown in Figure 9b. With
5 pressure released from the pawl control actuator to allow rotation of double ended pawl 148n through contact with the projecting lug 145, I-beam 139 is now driven forward, pushing thrust assembly 146n past projecting lug 145. The pawl control ram now extends to return double ended pawls
10 148n into the return thrust position shown in Figure 9c enabling the retraction stroke of I-beam 139 to complete the first return increment of material urging structure 112 towards rear end 113.

The remaining returning increments are a reverse
15 procedure of the intermediate incrementing sequence described above.

First forward increment

The final rearward incremental retraction of the main
20 rams 142 causes projecting lug 145 to reach the position at rear end 113 of container structure 111 as shown in Figure 10a. I-beam 139 is provided at this end with a forward thrust block 167.

- 45 -

At the first extension of main ram 142 from this position of the material urging structure 112 at rear end 113, it is the forward thrust block 167 which pushes the projecting lug 145 and hence material urging structure 112 forward to the first partially incremented position shown in Figure 10b. When this position has been reached, pawl control actuator is retracted to rotate double ended pawl 148a into its forward thrust position as shown in Figure 10b.

Pressure is then released from the pawl control actuator and the I-beam retracted to pull thrust assembly 146a past projecting lug 145. Pawl control actuator 166 then retracts to return double ended pawls 148a into their forward thrust position. The main ram 142 then extends to complete the first incremental advance of the material urging structure, followed by the intermediate increment sequence described above.

As with the first embodiment, in this embodiment of the invention also, the container structure may optionally be fitted with an intermediate compaction gate to allow the sequential assembling of a full compacted load from smaller compacted quantities of waste material.

Although both the first and the second embodiments described above are directed at compaction and the

- 46 -

incremental urging mechanisms act in conjunction with a container structure, the principle of the mechanisms may be applied for example to drive solid materials along a supporting surface. Thus the system may be adapted to drive
5 an array of palletized materials or containers along the length of a loading dock for transfer into a transport vehicle. In such a system the urging mechanisms may be disposed at floor level or recessed into channels along both sides of the dock with the equivalent of the material
10 urging structure adapted to slide on the surface of the loading dock or on suitable friction reducing means such as rails or wheels or a combination of these.

Third Embodiment

While uni-directional compaction of a volume of refuse
15 as described in the above embodiments greatly reduces the cost of waste handling and transportation, greater compaction and further economies can be achieved by applying compressive forces in more localized areas and in different directions within the refuse volume.

20 There are therefore provided in this embodiment additional devices which may optionally be fitted to the container structure of the first and second embodiments as previously described.

- 47 -

With reference to Figure 11, a refuse compacting container structure 211 is constructed in similar manner to the container structures of the first and second embodiments and incorporates a material urging structure 5 212 and incremental urging mechanisms, (not shown) as previously described. Likewise it is provided with top opening 218 and top opening cover 219 and a discharge gate 213. As with the first and second embodiments the structure may optionally be provided with an intermediate compaction 10 gate to allow for the compaction of smaller quantities of refuse material.

In a preferred first form of this embodiment, at least one additional compaction device 220 is provided along each of the two side walls 216 of the container structure 211 in 15 the area between the top opening and the discharge end of the container. Where a container structure is provided with an intermediate compaction gate the additional compaction devices may best be placed in the area between the top opening and the intermediate gate, but could also be 20 located between the intermediate gate and the discharge gate or even in both these areas.

Again with reference to Figure 11, each device 220 is in the form of a generally rectangular shaped compactor plate 230 attached to a support structure 224. Support

- 48 -

structure 234 is hinged at end 231 to pivot about a shaft 232 located in bearing housings 233 attached to the side wall members 216. The support structure 234 is adapted to pivotally accept the rod end of an hydraulic ram 235, the
5 passive end 236 of which is pivotally attached to the side wall of the container structure.

Apertures in the side walls are adapted to accept the shape of the compactor plate 230 and attachment structure 234 so that when the hydraulic ram of a compaction device
10 is activated, the compactor plate is rotationally driven through the aperture to impact on any refuse material in that area of the container structure.

Initially, during the loading of refuse into the container structure and subsequently during the passage of
15 the material urging structure towards the forward end, the compactor plates of the compaction devices are maintained flush with the internal walls of the container structure. The devices are best brought into action when a sufficient amount of partly compacted material has been accumulated in
20 the area in which the devices are located.

Attachment structures 234 are preferably shaped so as to shut off the aperture through which the compaction device acts so as to prevent refuse material being pulled back through the aperture 237 as the compactor plate 230 is

- 49 -

retracted to its position flush with the internal surface
the of side wall.

In a second preferred form of this embodiment the
additional compaction devices are mounted from the roof of
5 the container structure and operate through apertures in
the roof.

Fourth Embodiment

In a further preferred embodiment of the invention the
10 container structure of the first and second embodiments as
described above is provided with other additional
compaction urging sub-systems. In this form at least a
portion of the floor of the container structure is
articulated so as to be driven vertically upward by
15 actuators so as to intrude into the container volume from
below. The floor portion may be so articulated as a single
section or in a number of sections so as to apply maximum
compaction force to relatively small volumes of compactable
material.

20 Similarly, a portion of the roof of the container
structure, singly or in sections, may be articulated to
provide compaction force from above. These compacting
forces acting from below and from above may then be applied
together or in an alternating sequence to the compactable

material to provide the maximum disturbance so as to minimise voids. A sequence may include periods where both the upper and lower compacting surfaces advance followed by rapid reversals of direction so as to agitate the material.

5 In a further aid to agitation the floor of the container structure may be provided with oscillating or reciprocating plate sections set into shallow scalloped recesses so as not to impede the advance of the incrementing material urging structure as described in the
10 previous embodiments.

Fifth Embodiment

In a fifth preferred embodiment of the invention, the incremental advancing mechanism of the first or second
15 embodiments described above is adapted to the unloading of a transport vehicle. In this instance the object of the mechanism is not to compact but to remove a substantially unobstructed load, such as for example a compacted refuse load from a transport vehicle.

20 With reference to Figure 12, a transport vehicle 300 is shown in which the outer surface of one side and a portion of the internal wall of that side have been removed. Transport vehicle 300 is provided with material urging structure 310 extending between floor 313, ceiling

- 51 -

315 and internal walls 314 and adapted to slide along the floor 313 of the vehicle.

Disposed along each side of the transport vehicle are urging mechanisms 319. Urging mechanisms 319 include rail structures extending along the length of the vehicle, which carry reciprocating beams activated by hydraulic rams 316. Each reciprocating beam is provided with thrust assemblies at intervals along its length; these assemblies being in the form described in the first or second embodiments above. Since no compaction is required the hydraulic rams driving the material urging structure are of significantly smaller diameter, and the components of the incrementing mechanism proportionately lighter in construction than those of the previously described embodiments.

The thrust assemblies are caused to act sequentially on material urging structure 310 which is provided, after the manner of the previously described embodiments, with lugs which project from each of its sides through slots 318 along internal walls 314 of the vehicle.

In use, a transport vehicle fitted with this mechanism is loaded while material urging structure 310 is fully retracted to the front end 311 of the vehicle 300. At a discharge site it remains simply to open the doors at rear

- 52 -

end 312 and activate the incremental advancing mechanisms to completely empty the transport vehicle.

Sixth Embodiment

5 In a sixth embodiment of an incremental material urging system there is provided a rail system, a material urging structure and an incrementing drive mechanism.

With reference to Figure 13, floor 410 is provided with at least a pair of parallel spaced apart fixed rails
10 411. A material urging structure 412 is adapted to move along rails 411, supported on friction reducing means such as bearing surfaces, internally mounted wheels or linear bearings. Pivotaly attached at the rear end 413 of urging structure 412 are extendable linear actuators 414, which
15 may, for example, be pneumatic or hydraulic rams. The active or rod ends 415 of linear actuators 414 are provide with clamping mechanisms 416 adapted to slide along rails 411 when released and, when activated, clamp onto the sides of the rails with suitable calipers.

20 For the material urging structure 412 to incrementally advance along rails 411, linear actuators 414 are initially retracted as shown in Figure 13a. Clamping mechanisms 416 are then activated to clamp onto rails 411 and the linear actuators extended as in Figure 13b to push the urging

- 53 -

structure along the rails. The clamping mechanisms are now released and the actuators retracted, upon which the sequence of clamping, extending the actuators, releasing the clamps and retracting the actuators is repeated to
5 incrementally advance the urging structure along the rails.

Urging structure 412 may be incrementally reversed along the rails by a reverse sequence of the linear actuator extensions and retractions and the clamping mechanisms.

10 In an alternative preferred form of this embodiment, the rails may be substituted by channels let into a floor structure and in which the clamping mechanisms comprise outwardly acting calipers to act on the internal sides of the channels. In this form of the embodiment the urging
15 structure may be adapted to slide on the floor surface or be provided with friction reducing means such as for example wheels.

In use, the mechanism may be used to advance objects along a platform such as for example a loading dock. Thus,
20 again by way of example, an array of two rows of pallets making up the entire load intended for a flat bed transport vehicle may be transferred from the loading dock in a series of incremental linear movements. For this application a preferred arrangement of the rails is that of

- 54 -

two pairs of rails, each pair suitably spaced to provide support and guidance to the rows of pallets.

In further examples of applications of this embodiment, the device may be installed in a transport
5 vehicle for the purpose of ejecting a load from the vehicle, or when fitted to the container structure of a refuse transfer station it may be used to incrementally drive a material urging structure.

In yet a further example of the use of the device, the
10 rails may include curved sections.

The urging structure may be fitted with braking means to maintain it at any incremented position while the linear actuators re-position the clamping mechanisms. When
provided with such braking means the urging structure may
15 be adapted to operate along inclined surfaces.

Seventh Embodiment

In a seventh preferred embodiment of the invention an incremental material urging system comprises a set of
20 reciprocating rail structures, a material urging structure and clamping mechanisms.

With reference to Figure 14, floor structure 510 is provided with at least a pair of parallel spaced apart rails 511 adapted to slide on the floor surface or on a

- 55 -

series of suitable linear bearings or wear pads (not shown). Rails are interconnected by yoke 513 at one end and yoke 513 is in turn connected to a linear actuator 514 such as, for example, an hydraulic ram.

5 Floor structure 510 is further provided with a plurality of arresting pins 517 retracted flush with the floor when not in use but adapted to project a certain distance above floor level when required. Arresting pins 517 are arranged, preferably in pairs transverse to the
10 rails, at intervals along floor 510 corresponding to the stroke length of linear actuator 514.

A material urging structure 512 is adapted to ride on rails 511 and is provided with clamping mechanisms 516 adapted to grip onto the rails. An incremental movement of
15 material urging structure 512 may then be effected by applying clamps 516 and activating linear actuator 514 to urge an incremental movement of rails 511 thereby forcing a corresponding movement of urging structure 512.

Thus for a movement in the direction away from the
20 linear actuator as mounted in Figure 14, the extension of the linear actuator with the clamping mechanisms locking it to the rails, will drive the urging structure in the desired direction. For a subsequent increment the arresting pins immediately behind the current position of the urging

- 56 -

structure are raised to project from the floor, the clamps are released and the linear actuator retracted to draw the rails back into their initial position ready for the next increment.

5 Clearly the sequence when reversed allows for the movement of the urging structure in the opposite direction also. In a further form of this embodiment the arresting pins acting through the floor may be replaced by a locking system incorporated in the material urging structure
10 itself. One form of such a locking system comprises friction pads driven downwardly from the urging structure against the floor, providing sufficient friction to prevent the urging structure from being moved from its current position through the repositioning of the rails for the
15 next increment. In a further preferred form, the urging structure is lifted clear of contact with the rails while these are retracted for a next increment.

 In yet a further alternative form of this embodiment the material urging structure is supported on wheels or
20 other friction reducing means on the floor and not on the articulated rails which instead pass through clearance channels in the structure or below the structure so that when the clamps are released the rails may be relocated with no disturbance to the urging structure.

- 57 -

The device as described may be used as both a means of transferring a load from a loading dock onto a transport vehicle or, when fitted to the floor of a transport vehicle, for the unloading of that vehicle.

5 Again, when fitted to the container structure of a refuse transfer station the device may be used to drive a material urging structure for the compaction of a refuse load.

10 The above describes only some embodiments of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope and spirit of the present invention.

- 58 -

CLAIMS

1. An incremental material urging system comprising:

(a) a container structure having a rear end and a forward end,

5 (b) a material urging structure

(c) material urging structure activating means wherein said material urging structure is incrementally advanced from a retracted position at said rear end of said container structure, to
10 a fully advanced position at said forward end of said container structure, where said forward end is a discharge end.

2. The material urging system of claim 1 wherein said container structure includes;

15 (a) a floor sub-structure

(b) side wall sub-structures

(c) a roof

(d) a top opening

(e) a top opening cover

20 (f) a discharge end closure means

3. The material urging system of Claim 2 wherein said material urging structure is incrementally retracted by said activating means from said discharge end to said rear end of said container structure,

4. The material urging system of claim 3 wherein said activating means are disposed along each side wall of said container structure and wherein said activating means operate substantially in unison.
- 5 5. The material urging system of claim 4 wherein the material urging structure is a close sliding fit within said container structure, said material urging structure adapted to slide on the surface of said floor sub-structure.
- 10 6. The material urging system of claim 4 wherein each of said side wall substructures is provided with a slot extending substantially along the length of said wall substructure, said slot providing a separation between an upper and a lower portion of internal wall
15 sheeting.
7. The material urging system of claim 6 wherein said material urging structure is provided on each side of said structure with a projecting lug, each one of said lugs projecting through one of said slots.
- 20 8. The material urging system of claim 7 wherein each of said slots is co-linear with a rail system said rail system adapted to support and guide a reciprocating beam.

- 60 -

9. The material urging system of claim 8 wherein said reciprocating beam is provided with a plurality of thrust assemblies, said thrust assemblies disposed at substantially equal intervals along the length of said beam, between a forward end and a rear end of said beam.
10. The material urging system of claim 9 wherein each of said thrust assemblies includes;
- (a) an assembly support
 - 10 (b) a double ended pawl
 - (c) a pawl pivot shaft
 - (d) a pawl actuator means
11. The material urging system of claim 10 wherein said double ended pawl is rotatable about said pawl pivot shaft by said pawl actuator means from a first forward thrusting position to a second rearward thrusting position.
12. The material urging system of claim 11 wherein said pawl actuator means is a linear actuator.
- 20 13. The material urging system of claim 12 wherein each of said double ended pawls is rotated by a linear actuator; said actuator pivotally connected at a first end to one end of said double ended pawls and at a second end to said reciprocating beam.

- 61 -

14. The material urging system of claim 12 wherein each of said double ended pawls is provided with a pawl control bracket, said bracket supporting a control pivot shaft.

5 15. The material urging system of claim 14 wherein each of said control pivot shafts is pivotally connected to a common control arm, said control arm being pivotally connected at an outer end to a linear actuator and wherein said actuator is pivotally connected to said
10 reciprocating beam.

16. The material urging system of claim 15 wherein each one of said double ended pawls is adapted to thrust against the rearward facing side of said projecting
lug when said double ended pawl is in said forward
15 thrusting position and to thrust against the forward facing side of said projecting lug when said double ended pawl is in a rearward thrusting position.

17. The material urging system of claim 16 wherein that
portion of a first pawl of said double ended pawls
20 adapted to thrust against said projecting lug presents a vertical outer surface when set in said thrusting position; the second pawl then rotated to a position precluding potential contact with said projecting lug.

- 62 -

18. The material urging system of claim 17 wherein the opposite face of each of said pawls of said double ended pawls is a sloping face, said sloping faces intersecting on the bisector of the double ended pawls so as to form a shallow "V" shaped space and where the sloping opposite face of that pawl set to a thrusting position is adapted to impart a turning moment to said pawls when impacting on said projecting lug while said pawl actuator is deactivated.
- 10 19. The material urging system of claim 18 wherein said double ended pawls may be rotated when impacted by a said sloping face to a position about said pivot shaft such that said projecting lug is able to pass said thrust assembly.
- 15 20. The material urging system of claim 19 wherein said reciprocating beam is urged into reciprocating motion by an hydraulic ram pivotally connected at a first end of said ram to said reciprocating beam and at a second end of said ram to said container structure.
- 20 21. The material urging system of claim 20 wherein said reciprocating beam is fitted at its forward outer end with an initial retraction thrust block and at its rear outer end with an initial advance thrust block.

- 63 -

22. The material urging system of claim 21 wherein, when said material urging structure is in a fully retracted first position at said rear end of said container structure and said hydraulic ram is retracted, said projecting lug is located between said initial advance thrust block and the first thrust assembly located nearest said rear end of said reciprocating beam.

23. The material urging system of claim 22 wherein the sequence of said material urging structure activating means for a first forward movement of said material urging structure comprises the steps of:

(a) extending said hydraulic ram to urge said initial advance thrust block into contact with said projecting lug so as to drive said lug and said material urging structure to a first partial forward incremented position,

(b) retracting said pawl control actuator to rotate said double ended pawl into a forward thrust position,

(c) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said forward thrust position is contacted by said projecting lug,

- 64 -

(d) retracting said hydraulic ram so as to retract said thrust assembly nearest to rear end of said reciprocating beam past said projecting lug,

5 (e) retracting said pawl control actuator to reset said double ended pawls of said thrust assembly nearest to rear end of said reciprocating beam to said forward thrust position,

10 (f) extending said hydraulic ram to drive said thrust assembly nearest to rear end of said reciprocating beam into contact with said projecting lug thereby driving said material urging structure to a completed first forward increment.

24. The material urging system of claim 23 wherein
15 subsequent forward increments of said material urging structure comprise the steps of:

(a) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when contacted by said projecting lug,

20 (b) retracting said hydraulic ram so as to retract the next forward thrust assembly past said projecting lug,

- 65 -

(c) retracting said pawl control actuator to reset the next forward thrust assembly to said forward thrust position,

(d) extending said hydraulic ram to drive forward said next forward thrust assembly thereby driving said material urging structure to a next forward incremented position.

25. The material urging system of claim 24 wherein, when said material urging structure is in a fully advanced position at said forward end of said container structure and said hydraulic ram is extended, said projecting lug is located between said initial retract thrust block and the thrust assembly located nearest said forward end of said reciprocating beam.

26. The material urging system of claim 25 wherein the sequence for a first rearward movement of said material urging structure comprises the steps of:

(a) retracting said hydraulic ram to urge said initial retract thrust block into contact with said projecting lug thereby driving said lug and said material urging structure to a first partial rearward incremented position,

- 66 -

(b) extending said pawl control actuator to rotate said double ended pawl into a rearward thrust position,

5 (c) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said rearward thrust position is contacted by said projecting lug,

10 (d) extending said hydraulic ram so as to advance said thrust assembly nearest to forward end of said reciprocating beam past said projecting lug,

(e) extending said pawl control actuator to reset said double ended pawls of said thrust assembly nearest to rear end of said reciprocating beam to
15 said rearward thrust position,

27. The material urging system of claim 26 wherein subsequent rearward increments of said material urging structure comprise the steps of:

20 (a) deactivating said pawl control actuator so as to allow rotation of said double ended pawls when contacted by said projecting lug,

(b) extending said hydraulic ram so as to advance the next rearward thrust assembly past said projecting lug,

- 67 -

(c) extending said pawl control actuator to reset the next rearward thrust assembly to said rearward thrust position,

(d) retracting said hydraulic ram to drive rearward said next rearward thrust assembly thereby driving said material urging structure to a next rearward incremented position.

28. The material urging system of any of claims 1 to 27 wherein said urging system is adapted to the compaction of refuse.

29. The material urging system of claim 28 wherein said roof is provided with an openable aperture for the introduction of refuse into said container structure.

30. The material urging system of claim 29 wherein said closure means is in the form of a discharge gate, said gate adapted to provide a reaction surface for the compaction of said refuse between said discharge gate and said material urging structure.

31. The material urging system of claim 30 wherein said container structure is provided with an intermediate openable gate positioned between said discharge gate and said openable aperture in said roof, said intermediate gate adapted to provide a reaction

- 68 -

surface for the compaction of refuse between said intermediate gate and said material urging structure.

32. The material urging system of claim 31 wherein said container structure is provided with a plurality of articulated compaction devices; said devices supported by hinges along said sides of said container structure; said devices acting through apertures in said sides to intrude into a volume of refuse contained in said container structure.

33. The material urging system of claim 32 wherein said articulated compaction devices are hinged from said roof of said container structure; said compaction devices acting through apertures in said roof.

34. The material urging system of claim 30 wherein said container structure is provided with at least one articulated section of said floor; said floor section adapted to rise vertically within said container structure to provide compaction force on a volume of refuse.

35. The material urging system of claim 30 wherein said container structure is provided with at least one articulated section of said roof; said roof section adapted to descend vertically within said container

- 69 -

structure to provide compaction force on a volume of refuse.

36. The material urging system of any of claims 30 to 35 wherein said urging system is adapted to the transfer of a compacted volume of refuse from said container structure into a transport vehicle.

37. The material urging system of claim 36 wherein said system is adapted to the retrofitting of said system to existing refuse transfer stations.

38. The material urging system of claim 35 wherein said system is adapted to the reduction in volume of any compactable material.

39. The material urging system of claim 35 wherein said system is adapted to the discharge of material from a transport vehicle, the load container of said vehicle forming a container structure.

40. An incremental material urging system comprising;

(a) a floor structure,

(b) at least a pair of guide elements extending in spaced apart parallel configuration along a portion of said floor structure,

(c) a material urging structure adapted to incremental movement along said guide elements, said urging structure provided with a load urging

- 70 -

surface normal to said floor structure and
transverse to said guide elements,

(d) a material urging structure incrementing means.

41. The material urging system of claim 40 wherein said
5 material urging structure includes a substantially
vertical surface adapted to act against moveable load
objects.

42. The material urging system of claim 41 wherein said
urging structure incrementing means include:

- 10 (a) at least one linear actuator,
(b) a guide element clamping mechanism associated
with each said linear actuator.

43. The material urging system of claim 42 wherein each
said linear actuator is attached at a first end to a
15 rear portion of said urging structure and at a second
end to a said rail clamping mechanism; said linear
actuator lying substantially in the vertical plane
through said guide element.

44. The material urging system of claim 43 wherein said
20 clamping mechanism comprises a clamping caliper
provided with gripping pads adapted to apply
frictional force to each side of said guide element.

45. The material urging system of claim 44 wherein said
linear actuator is an hydraulic ram.

46. The material urging system of claim 44 wherein said clamping caliper is activated by an hydraulic ram.

47. The material urging system of claim 42 wherein an increment of said urging structure for the purpose of advancing said load objects along said floor structure is effected by the steps of:-

(a) extension of said linear actuator while said clamping mechanism is activated to grip said guide element,

(b) deactivating said clamping mechanism,

(c) retracting said linear actuator.

48. The material urging system of claim 43 wherein an increment of said urging structure for the purpose of retracting said urging structure is effected by the steps of:

(a) retraction of said linear actuator while said clamping mechanism is activated to grip said guide element,

(b) deactivating said clamping mechanism,

(c) extending said linear actuator.

49. The material urging system of claim 48 wherein said guide element is a rail.

- 72 -

50. The material urging system of claim 49 wherein said guide element is a channel let into said floor structure.

51. An incremental material urging system comprising;

- 5 (a) a floor structure,
- (b) at least a pair of rail elements extending in spaced apart parallel configuration along a portion of said floor structure,
- 10 (c) a yoke providing a transverse linking of said rail elements at one end of said rail elements,
- (d) a linear actuator linked to said yoke, the axis of said actuator disposed in parallel alignment to said rail elements, said actuator adapted to urge reciprocating movement of said rail elements
- 15 along said floor,
- (e) a material urging structure adapted to incremental movement along said rail elements, said urging structure provided with a vertical load urging surface normal to said floor
- 20 structure and transverse to said rail elements,
- (f) urging structure clamping elements, said elements adapted to releasably lock said urging structure to said rail elements.

52. The material urging system of claim 51 wherein said material urging structure is supported on said rail elements by friction reducing means.

53. The material urging system of claim 51 wherein said material urging structure is supported by said floor structure by friction reducing means.

54. The material urging system of claim 52 wherein said floor structure is provided with material urging structure arresting means.

10 55. The material urging system of claim 54 wherein said arresting means are comprised of a plurality of vertical articulated pins disposed in pairs transverse to said rail elements and at intervals along the length of said rail elements equivalent to the stroke length of said actuator, said pins adapted to move between a first retracted position flush with said floor and a second extended position projecting from said floor.

20 56. The material urging system of claim 53 wherein said material urging structure is provided with friction pads, said pads adapted to be driven downwardly relative to said urging structure so as to provide friction sufficient to arrest said structure at an incremented position.

57. A method for the compaction and transfer to a refuse transport means of a volume of refuse, said method including the steps of:-

- 5 (a) loading a quantity of refuse material through an opening in the roof of a container structure, said container structure provided with an incrementing material urging structure and an openable discharge gate,
- 10 (b) closing said opening so as to provide a sealed container envelope for said quantity of refuse,
- (c) incrementally advancing said urging structure to a desired degree of compaction of said refuse material,
- 15 (d) aligning the loading aperture of a refuse transport means with said discharge gate of said container structure,
- 20 (e) opening of said discharge gate and incrementing said material urging structure so as to discharge said refuse material into said refuse transport means.

58. A method for the removal of material from the container structure of a transport vehicle, said method including the steps of:-

- 75 -

(a) providing said container structure with a material urging structure, said structure provided with a load urging surface having an area equivalent to the internal cross-section of said container structure,

5

(b) activating said container structure with reciprocating mechanisms adapted to increment said urging structure between a first retracted end to a second discharge end.

AMENDED CLAIMS

[received by the International Bureau on 21 July 2003 (21.07.03);
claims 1-58 replaced by amended claims 1-63 (20 pages)]

SUBSTITUTE CLAIMS

1. An incremental material urging system comprising:
 - (a) a container structure having a rear end and a forward end,
 - (b) a material urging structure
 - (c) material urging structure activating means wherein said material urging structure is incrementally advanced from a retracted position at said rear end of said container structure, to a fully advanced position at said forward end of said container structure, where said forward end is a discharge end.
2. The material urging system of claim 1 wherein said container structure includes;
 - (a) a floor sub-structure
 - (b) side wall sub-structures
 - (c) a roof
 - (d) a top opening
 - (e) a top opening cover
 - (f) a discharge end closure means
3. The material urging system of Claim 1 or 2 wherein said material urging structure is incrementally retracted by said activating means from said discharge end to said rear end of said container structure,

4. The material urging system of any one of claims 1 to 3 wherein said activating means are disposed along each side wall of said container structure and wherein said activating means operate substantially in unison.
5. The material urging system of any one of claims 2 to 4 wherein said material urging structure is a close sliding fit within said container structure, said material urging structure adapted to slide on the surface of said floor sub-structure.
6. The material urging system of any one of claims 2 to 5 wherein each of said side wall substructures is provided with a slot extending substantially along the length of said side wall substructure, said slot providing a separation between an upper and a lower portion of internal wall sheeting.
7. The material urging system of claim 6 wherein said material urging structure is provided on each side of said material urging structure with a projecting lug, each one of said lugs projecting through one of said slots.
8. The material urging system of claim 6 or 7 wherein each of said slots is co-linear with a rail system said rail system adapted to support and guide a reciprocating beam.

9. The material urging system of claim 8 wherein said reciprocating beam is provided with a plurality of thrust assemblies, said thrust assemblies disposed at substantially equal intervals along the length of said beam, between a forward end and a rear end of said beam.
10. The material urging system of claim 9 wherein each of said thrust assemblies includes;
- (a) an assembly support
 - (b) a double ended pawl
 - (c) a pawl pivot shaft
 - (d) a pawl actuator means
11. The material urging system of claim 10 wherein said double ended pawl is rotatable about said pawl pivot shaft by said pawl actuator means from a first forward thrusting position to a second rearward thrusting position.
12. The material urging system of claim 10 or 11 wherein said pawl actuator means is a linear actuator.
13. The material urging system of any one of claims 10 to 12 wherein each said double ended pawl is rotated by a linear actuator; said actuator pivotally connected at a first end to one end of said double ended pawl and at a second end to said reciprocating beam.

14. The material urging system of any one of claims 10 to 13 wherein each said double ended pawl is provided with a pawl control bracket, said bracket supporting a control pivot shaft.
15. The material urging system of claim 14 wherein each said control pivot shaft is pivotally connected to a common control arm, said control arm being pivotally connected at an outer end to a linear actuator and wherein said actuator is pivotally connected to said reciprocating beam.
16. The material urging system of any one of claims 10 to 15 wherein each said double ended pawl is adapted to thrust against the rearward facing side of said projecting lug when said double ended pawl is in said forward thrusting position and to thrust against the forward facing side of said projecting lug when said double ended pawl is in a rearward thrusting position.
17. The material urging system of any one of claims 10 to 16 wherein that portion of a first end of said double ended pawl adapted to thrust against said projecting lug presents a vertical outer surface when set in said forward thrusting position or said rearward thrusting position; a second end of said double ended pawl then

rotated to a position precluding potential contact with said projecting lug.

18. The material urging system of claim 17 wherein each opposite face of each of said first end and said second end of said double ended pawl is a sloping face, each said sloping face intersecting on the bisector of said double ended pawl so as to form a shallow "V" shaped space and where said sloping opposite face of that end set to a thrusting position is adapted to impart a turning moment to said pawl when impacting on said projecting lug while said pawl actuator means is deactivated. .
19. The material urging system of claim 18 wherein each said double ended pawl may be rotated when impacted by a said sloping face to a position about said pivot shaft such that said projecting lug is able to pass said thrust assembly.
20. The material urging system of any one of claims 8 to 19 wherein said reciprocating beam is urged into reciprocating motion by an hydraulic ram pivotally connected at a first end of said ram to said reciprocating beam and at a second end of said ram to said container structure.

21. The material urging system of any one of claims 8 to 20 wherein said reciprocating beam is fitted at its forward outer end with an initial retraction thrust block and at its rear outer end with an initial advance thrust block.
22. The material urging system of claim 20 or 21 wherein, when said material urging structure is in a fully retracted first position at said rear end of said container structure and said hydraulic ram is retracted, said projecting lug is located between said initial advance thrust block and the first thrust assembly located nearest said rear end of said reciprocating beam.
23. The material urging system of any one of claims 20 to 22 wherein said reciprocating motion for a first forward movement of said material urging structure comprises the steps of:
 - (a) extending said hydraulic ram to urge said initial advance thrust block into contact with said projecting lug so as to drive said lug and said material urging structure to a first partial forward incremented position,

- (b) retracting said pawl actuator means to rotate said double ended pawl into a forward thrust position,
 - (c) deactivating said pawl actuator means so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said forward thrust position is contacted by said projecting lug,
 - (d) retracting said hydraulic ram so as to retract said thrust assembly nearest to rear end of said reciprocating beam past said projecting lug,
 - (e) retracting said pawl actuator means to reset said double ended pawls of said thrust assembly nearest to rear end of said reciprocating beam to said forward thrust position,
 - (f) extending said hydraulic ram to drive said thrust assembly nearest to rear end of said reciprocating beam into contact with said projecting lug thereby driving said material urging structure to a completed first forward increment.
24. The material urging system of any one of claims 20 to 23 wherein subsequent forward increments of said material urging structure comprise the steps of:

- (a) deactivating said pawl actuator means so as to allow rotation of said double ended pawl when contacted by said projecting lug,
- (b) retracting said hydraulic ram so as to retract the next forward thrust assembly past said projecting lug,
- (c) retracting said pawl actuator means to reset the next forward thrust assembly to said forward thrust position,
- (d) extending said hydraulic ram to drive forward said next forward thrust assembly thereby driving said material urging structure to a next forward incremented position.

25. The material urging system of any one of claims 20 to 24 wherein, when said material urging structure is in a fully advanced position at said forward end of said container structure and said hydraulic ram is extended, said projecting lug is located between said initial retract thrust block and the thrust assembly located nearest said forward end of said reciprocating beam.

26. The material urging system of any one of claims 21 to 25 wherein the sequence for a first rearward movement

of said material urging structure comprises the steps of:

- (a) retracting said hydraulic ram to urge said initial retract thrust block into contact with said projecting lug thereby driving said lug and said material urging structure to a first partial rearward incremented position,
- (b) extending said pawl actuator means to rotate said double ended pawl into a rearward thrust position,
- (c) deactivating said pawl actuator means so as to allow rotation of said double ended pawls when the sloping face of that pawl set to said rearward thrust position is contacted by said projecting lug,
- (d) extending said hydraulic ram so as to advance said thrust assembly nearest to forward end of said reciprocating beam past said projecting lug,
- (e) extending said pawl control actuator to reset said double ended pawls of said thrust assembly nearest to rear end of said reciprocating beam to said rearward thrust position,

27. The material urging system of any one of claims 21 to 25 wherein subsequent rearward increments of said material urging structure comprise the steps of:
- (a) deactivating said pawl actuator means so as to allow rotation of said double ended pawls when contacted by said projecting lug,
 - (b) extending said hydraulic ram so as to advance the next rearward thrust assembly past said projecting lug,
 - (c) extending said pawl actuator means to reset the next rearward thrust assembly to said rearward thrust position,
 - (d) retracting said hydraulic ram to drive rearward said next rearward thrust assembly thereby driving said material urging structure to a next rearward incremented position.
28. The material urging system of any of claims 1 to 27 wherein said urging system is adapted to the compaction of refuse.
29. The material urging system of any one of claims 2 to 28 wherein said roof is provided with an openable aperture for the introduction of refuse into said container structure.

30. The material urging system of claim 28 or 29 wherein said discharge end closure means is in the form of a discharge gate, said gate adapted to provide a reaction surface for the compaction of said refuse between said discharge gate and said material urging structure.
31. The material urging system of claim 30 wherein said container structure is provided with an intermediate openable gate positioned between said discharge gate and said openable aperture in said roof, said intermediate gate adapted to provide a reaction surface for the compaction of refuse between said intermediate gate and said material urging structure.
32. The material urging system of any one of claims 1 to 31 wherein said container structure is provided with a plurality of articulated compaction devices; said devices supported by hinges along said sides of said container structure; said devices acting through apertures in said sides to intrude into a volume of refuse contained in said container structure.
33. The material urging system of claim 32 wherein said articulated compaction devices are hinged from said roof of said container structure; said compaction devices acting through apertures in said roof.

34. The material urging system of any one of claims 2 to 33 wherein said container structure is provided with at least one articulated section of said floor substructure; said section adapted to rise vertically within said container structure to provide compaction force on a volume of refuse.
35. The material urging system of any one of claims 2 to 34 wherein said container structure is provided with at least one articulated section of said roof; said section adapted to descend vertically within said container structure to provide compaction force on a volume of refuse.
36. The material urging system of any of claims 1 to 35 wherein said material urging system is adapted to the transfer of a compacted volume of refuse from said container structure into a transport vehicle.
37. The material urging system of any preceding claim wherein said system is adapted to the retrofitting of said system to existing refuse transfer stations.
38. The material urging system of any preceding claim wherein said system is adapted to the reduction in volume of any compactable material.
39. The material urging system of any preceding claim wherein said system is adapted to the discharge of

material from a transport vehicle, the load container of said vehicle forming a container structure.

40. A material urging structure adapted to the transfer of material from a first loaded position to second unloaded position by incremental movements induced by reciprocating extensible urging means; where said reciprocating extensible urging means have an operating stroke significantly smaller than the separation between said first loaded position and said second unloaded position.
41. An incremental material urging system comprising;
- (a) an elongate floor structure,
 - (b) at least one guide element extending along a portion of said elongate floor structure,
 - (c) a material urging structure adapted to incremental movement along said at least one guide element, said urging structure provided with a load urging surface normal to said floor structure and transverse to said at least one guide element,
 - (d) a material urging structure incrementing means.
42. The material urging system of claim 41 wherein said material urging structure includes a substantially

vertical surface adapted to act against moveable load objects.

43. The material urging system of claim 41 or 42 wherein said urging structure incrementing means include:
- (a) at least one linear actuator,
 - (b) a guide element clamping mechanism associated with each said at least one linear actuator.
44. The material urging system of claim 43 wherein each said at least one linear actuator is attached at a first end to a rear portion of said urging structure and at a second end to a said guide element clamping mechanism; said at least one linear actuator lying substantially in a vertical plane through a corresponding one of said at least one guide element.
45. The material urging system of claim 43 or 44 wherein a said guide element clamping mechanism comprises a clamping caliper provided with gripping pads adapted to apply frictional force to each side of said at least one guide element.
46. The material urging system of any one of claims 43 to 45 wherein said at least one linear actuator is an hydraulic ram.

47. The material urging system of any one of claims 43 to 46 wherein a said guide element clamping mechanism is activated by an hydraulic ram.
48. The material urging system of any one of claims 43 to 47 wherein an increment of said urging structure for the purpose of advancing said load objects along said floor structure is effected by the steps of:
- (a) extension of said at least one linear actuator while said guide element clamping mechanism is activated to grip said at least one guide element,
 - (b) deactivating said guide element clamping mechanism associated with each said at least one linear actuator,
 - (c) retracting said at least one linear actuator.
49. The material urging system of any one of claims 43 to 47 wherein an increment of said urging structure for the purpose of retracting said urging structure is effected by the steps of:
- (a) retraction of said linear actuator while said guide element clamping mechanism associated with each said at least one linear actuator is activated to grip said guide element,

- (b) deactivating said guide element clamping mechanism,
 - (c) extending said at least one linear actuator.
50. The material urging system of any one of claims 41 to 49 wherein said at least one guide element is a rail.
51. The material urging system of any one of claims 1 to 49 wherein said at least one guide element is a channel let into said elongate floor structure.
52. An incremental material urging system comprising;
- (a) An elongate floor structure,
 - (b) at least one rail element extending along a portion of said elongate floor structure,
 - (c) a linear actuator linked by linking means to said at least one rail element, the axis of said actuator disposed in parallel alignment to said at least one rail element, said actuator adapted to urge reciprocating movement of said at least one rail element along said floor,
 - (d) a material urging structure adapted to incremental movement along said at least one rail element, said urging structure provided with a vertical load urging surface normal to said floor structure and transverse to said at least one rail element,

(e) at least one urging structure clamping element, said element adapted to releasably lock said urging structure to said at least one rail element.

53. The material urging system of claim 52 wherein said material urging structure is supported on said at least one rail element by friction reducing means.

54. The material urging system of claim 52 or 53 wherein said material urging structure is supported by said floor structure by friction reducing means.

55. The material urging system of any one of claims 52 to 54 wherein said floor structure is provided with material urging structure arresting means.

56. The material urging system of claim 55 wherein said arresting means are comprised of a plurality of vertical articulated pins disposed in pairs transverse to said at least one rail element and at intervals along the length of said at least one rail element equivalent to the stroke length of said linear actuator, said pins adapted to move between a first retracted position flush with said floor and a second extended position projecting from said floor.

57. The material urging system of any one of claims 52 to 54 wherein said material urging structure is provided

with friction pads, said pads adapted to be driven downwardly relative to said urging structure so as to provide friction sufficient to arrest said structure at an incremented position.

58. A method for the compaction and transfer to a refuse transport means of a volume of refuse, said method including the steps of:-

- (a) loading a quantity of refuse material through an opening in the roof of a container structure, said container structure provided with an incrementing material urging structure and an openable discharge gate,
- (b) closing said opening so as to provide a sealed container envelope for said quantity of refuse,
- (c) incrementally advancing said urging structure to a desired degree of compaction of said refuse material,
- (d) aligning the loading aperture of a refuse transport means with said discharge gate of said container structure,
- (e) opening of said discharge gate and incrementing said material urging structure so as to discharge said refuse material into said refuse transport means.

59. A method for the removal of material from the container structure of a transport vehicle, said method including the steps of:-

- (a) providing said container structure with a material urging structure, said structure provided with a load urging surface having an area equivalent to the internal cross-section of said container structure,
- (b) activating said material urging structure with reciprocating mechanisms adapted to increment said urging structure between a first retracted end to a second discharge end.

60. A method for the movement of material along a supporting surface from a first position to a second position, said method including the steps of:-

- (a) providing said supporting surface with a material urging structure, said structure provided with a load urging surface normal to said supporting surface,
- (b) activating said material urging structure with reciprocating mechanisms adapted to increment said urging structure between said first position and said second position.

61. The material urging system of any one of claims 1 to 40 wherein each increment of said material urging structure from said fully retracted position towards said fully advanced position moves material towards said discharge end.
62. The incremental material urging system of any one of claims 41 to 57 wherein each increment of said material urging structure from said fully retracted position towards said fully advanced position moves material towards said discharge end.
63. The method of any of claims 58 to 60 wherein each increment of said material urging structure from said fully retracted position towards said fully advanced position moves material towards said discharge end.

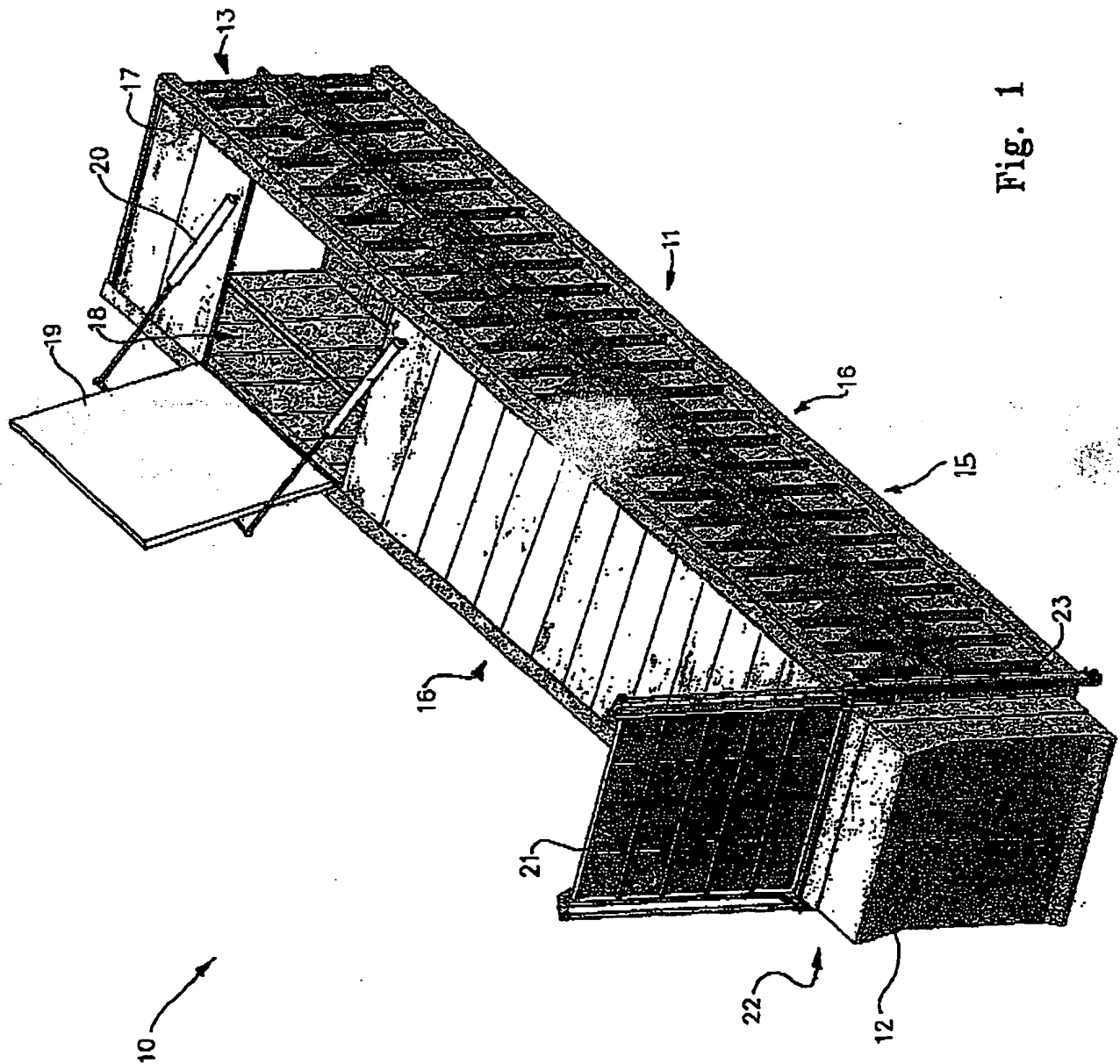


Fig. 1

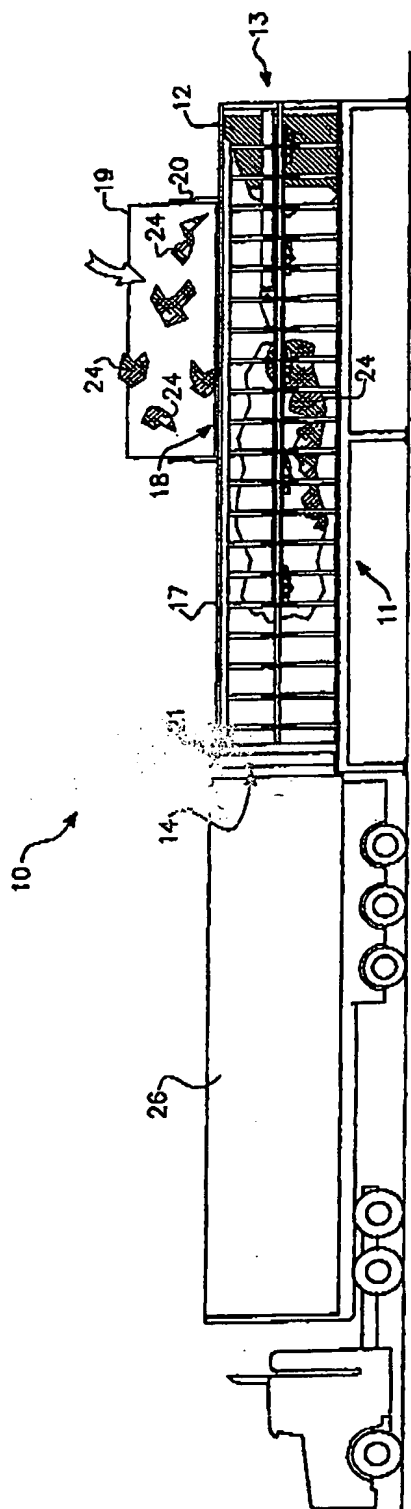


Fig. 2a

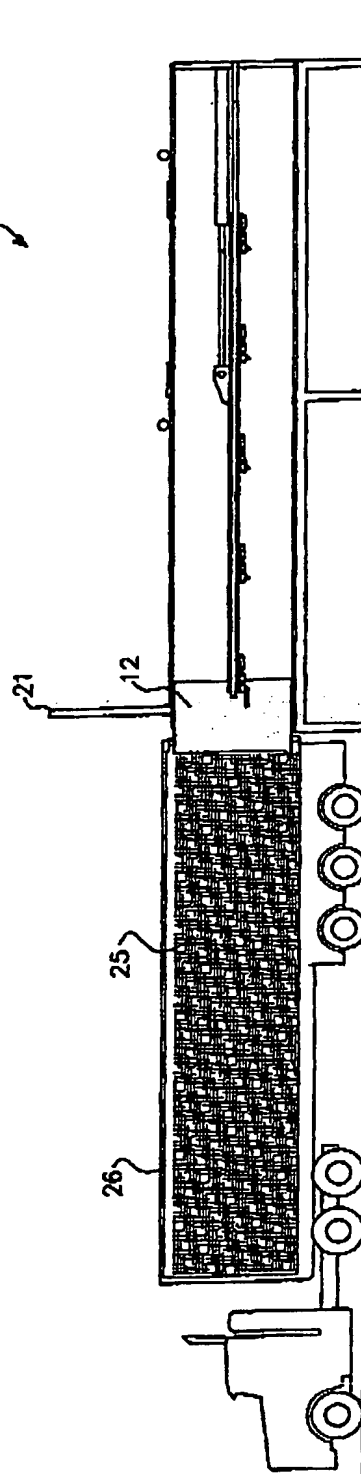


Fig. 2b

3/18

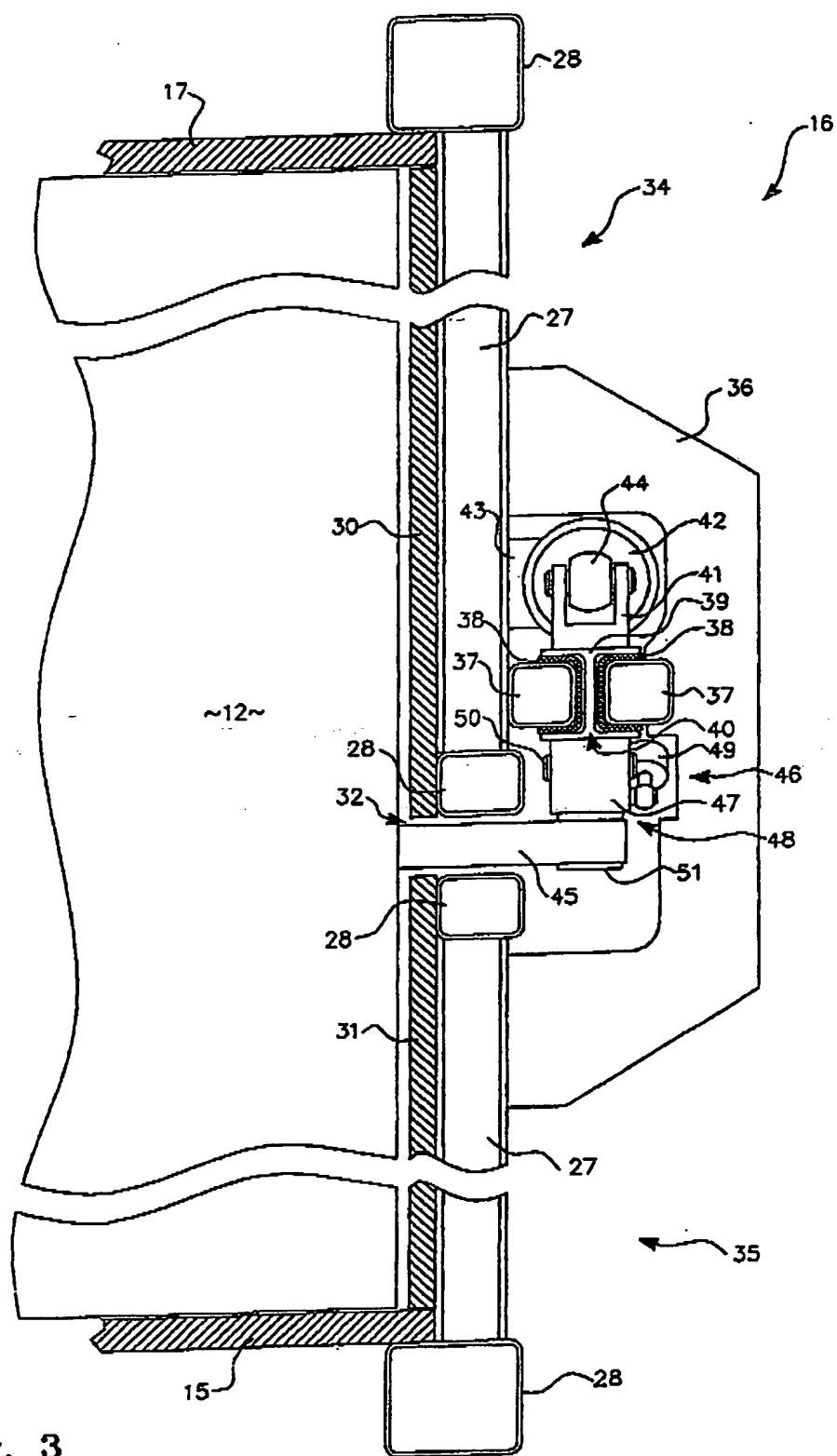


Fig. 3

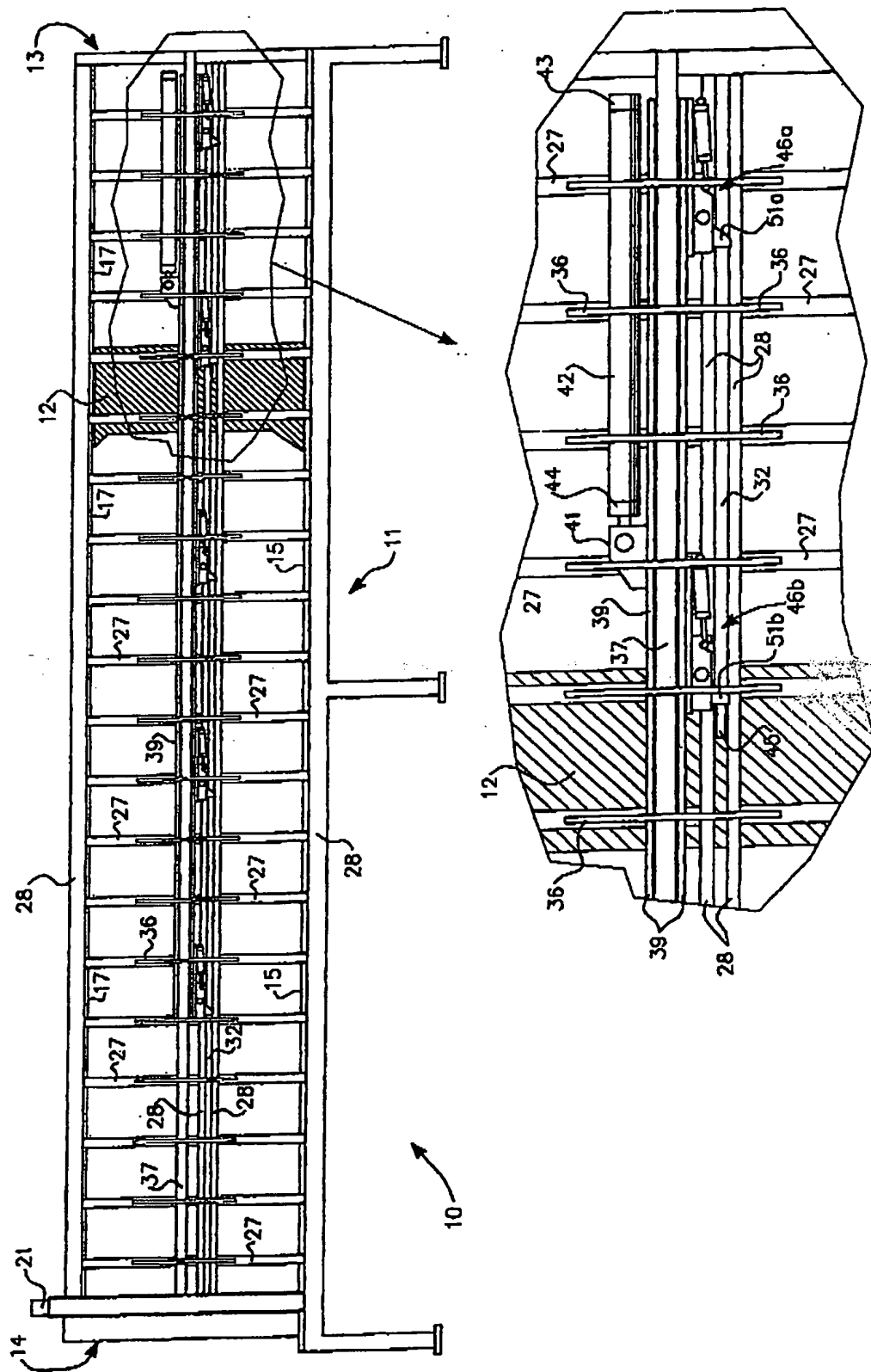


Fig. 4

5/18

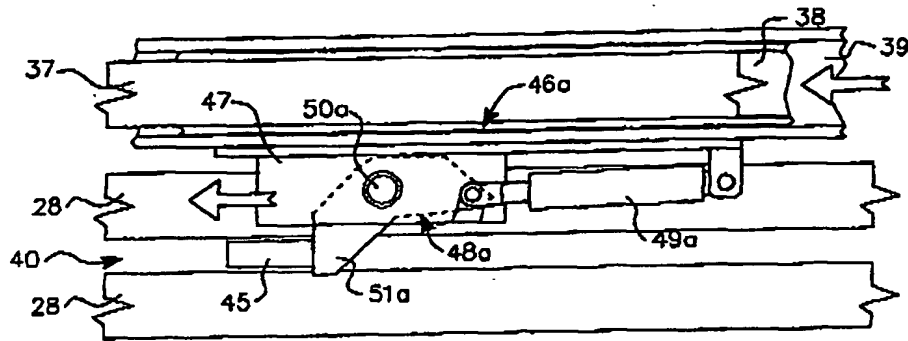


Fig. 5a

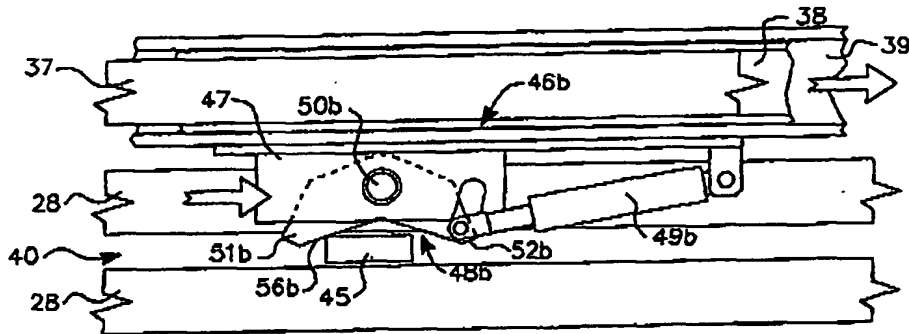


Fig. 5b

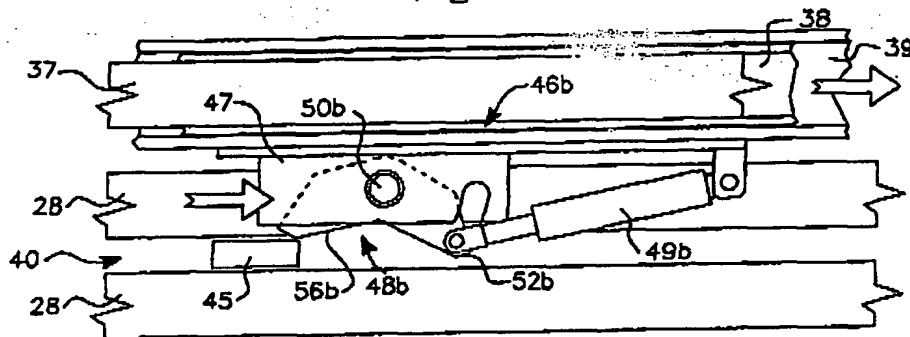


Fig. 5c

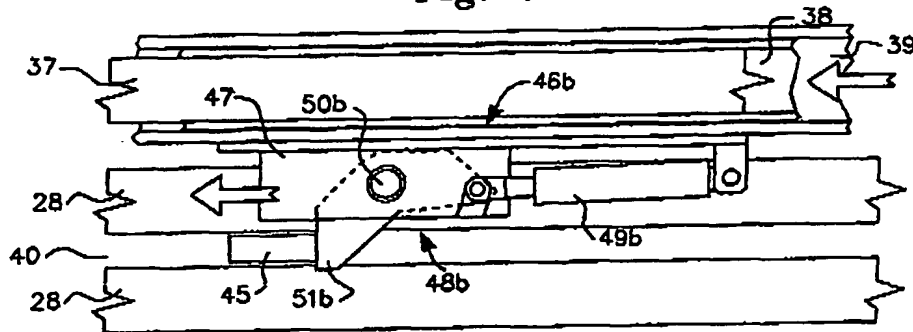


Fig. 5d

6/18

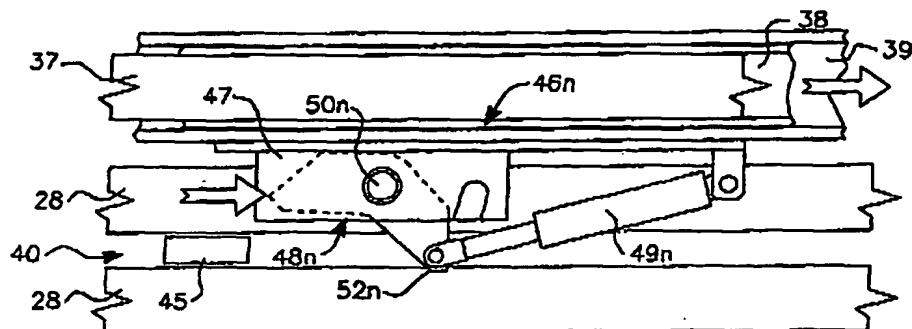


Fig. 6a

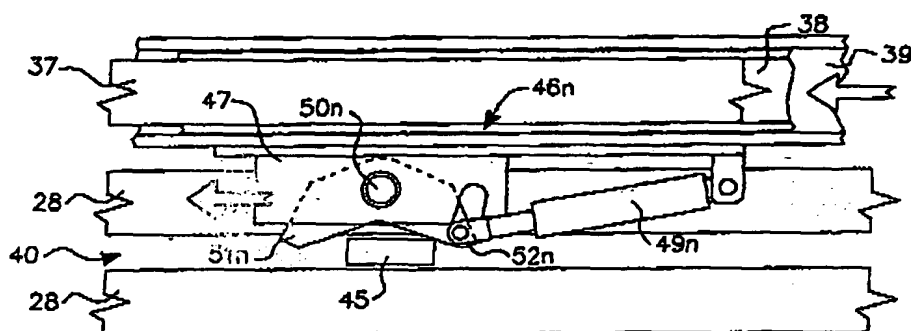


Fig. 6b

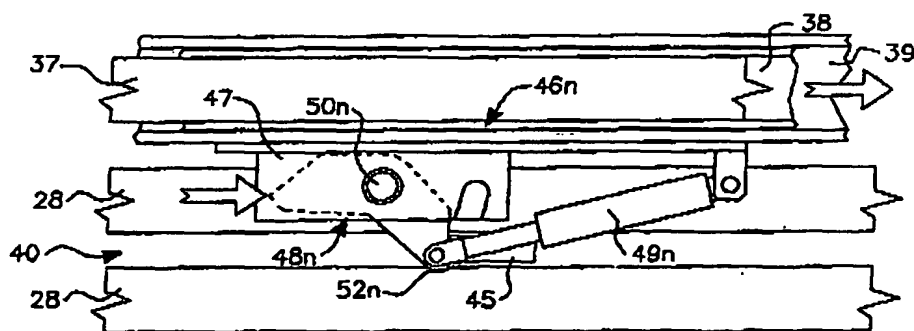


Fig. 6c

7/18

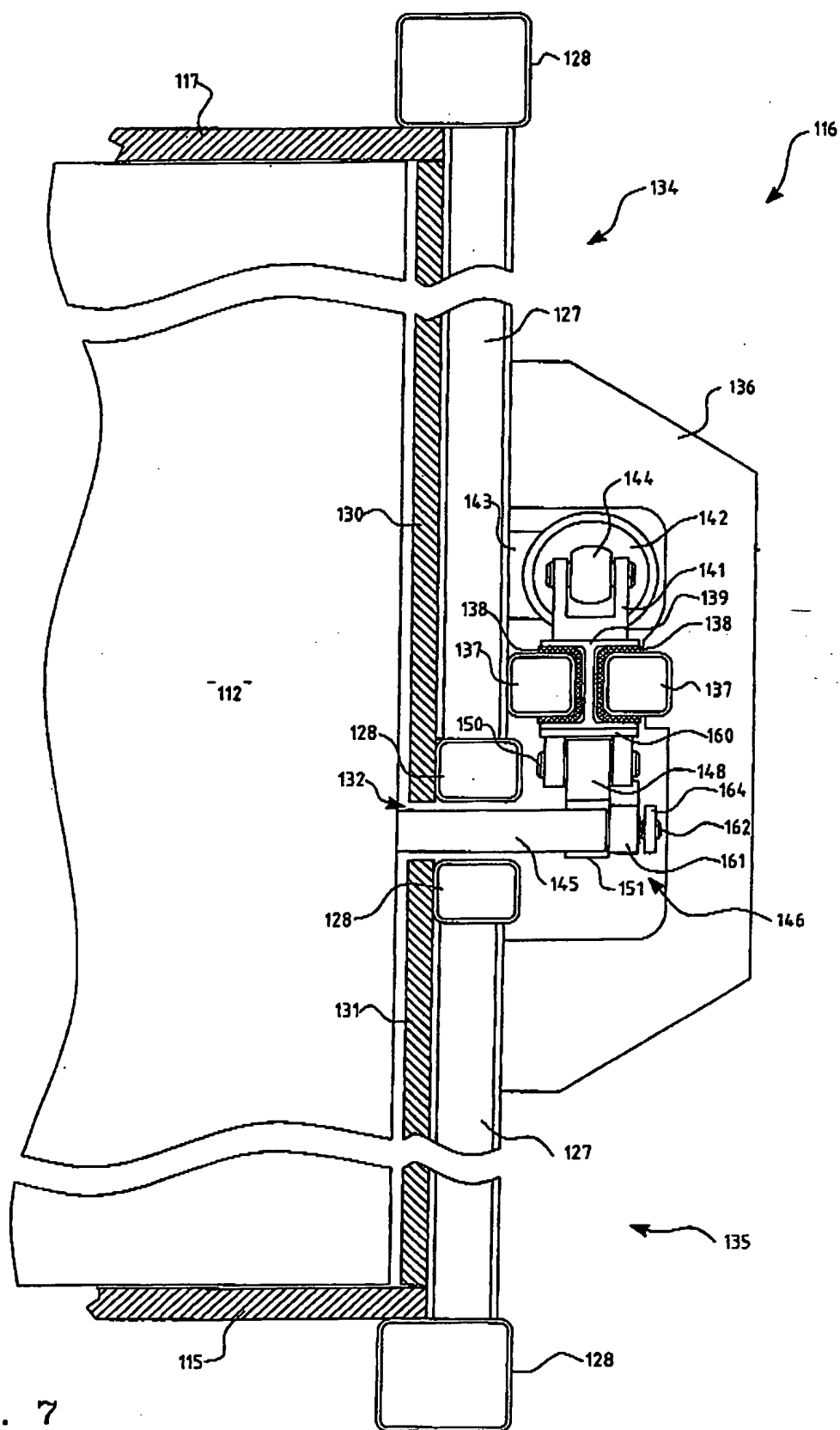


Fig. 7

8/18

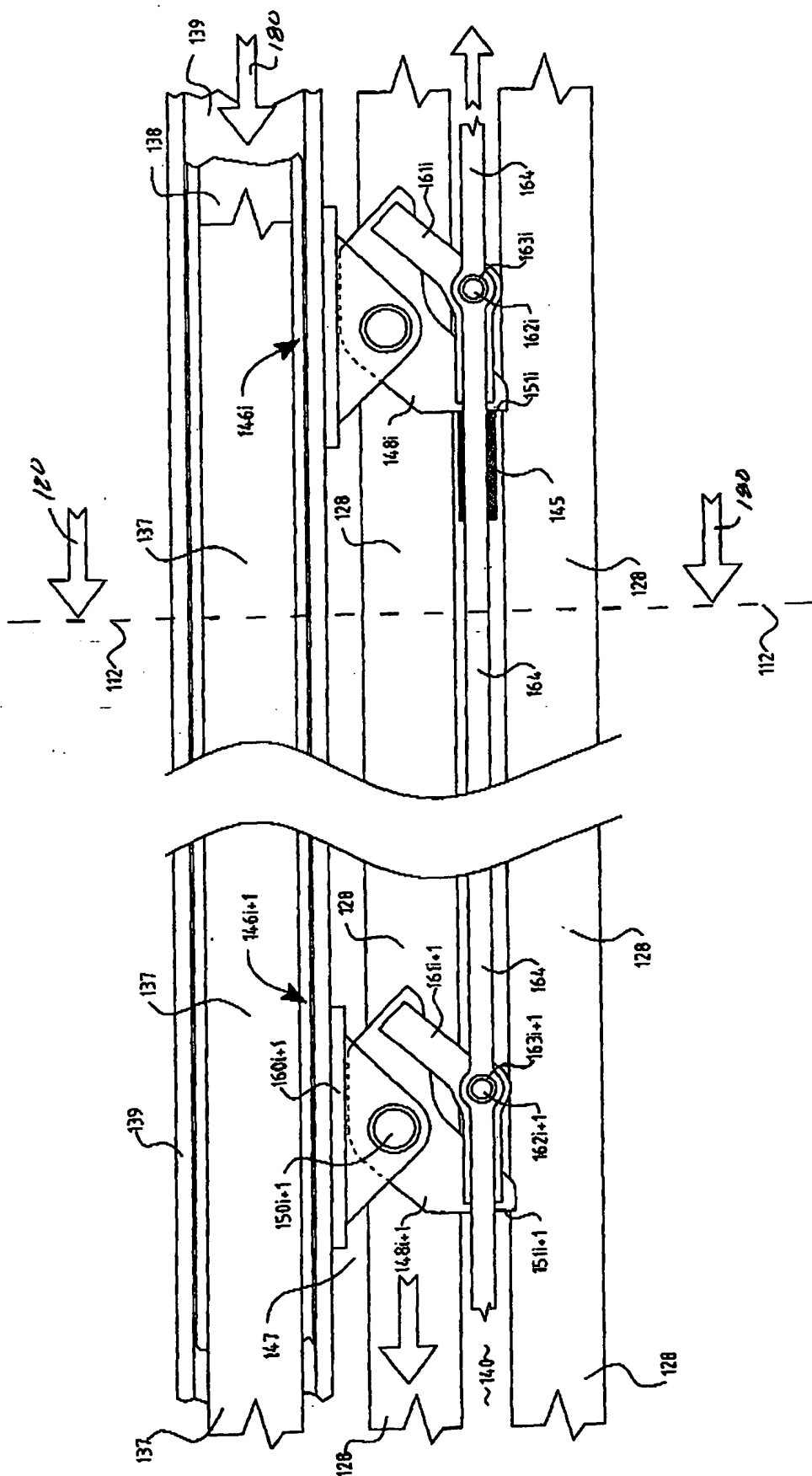


Fig. 8

9/18

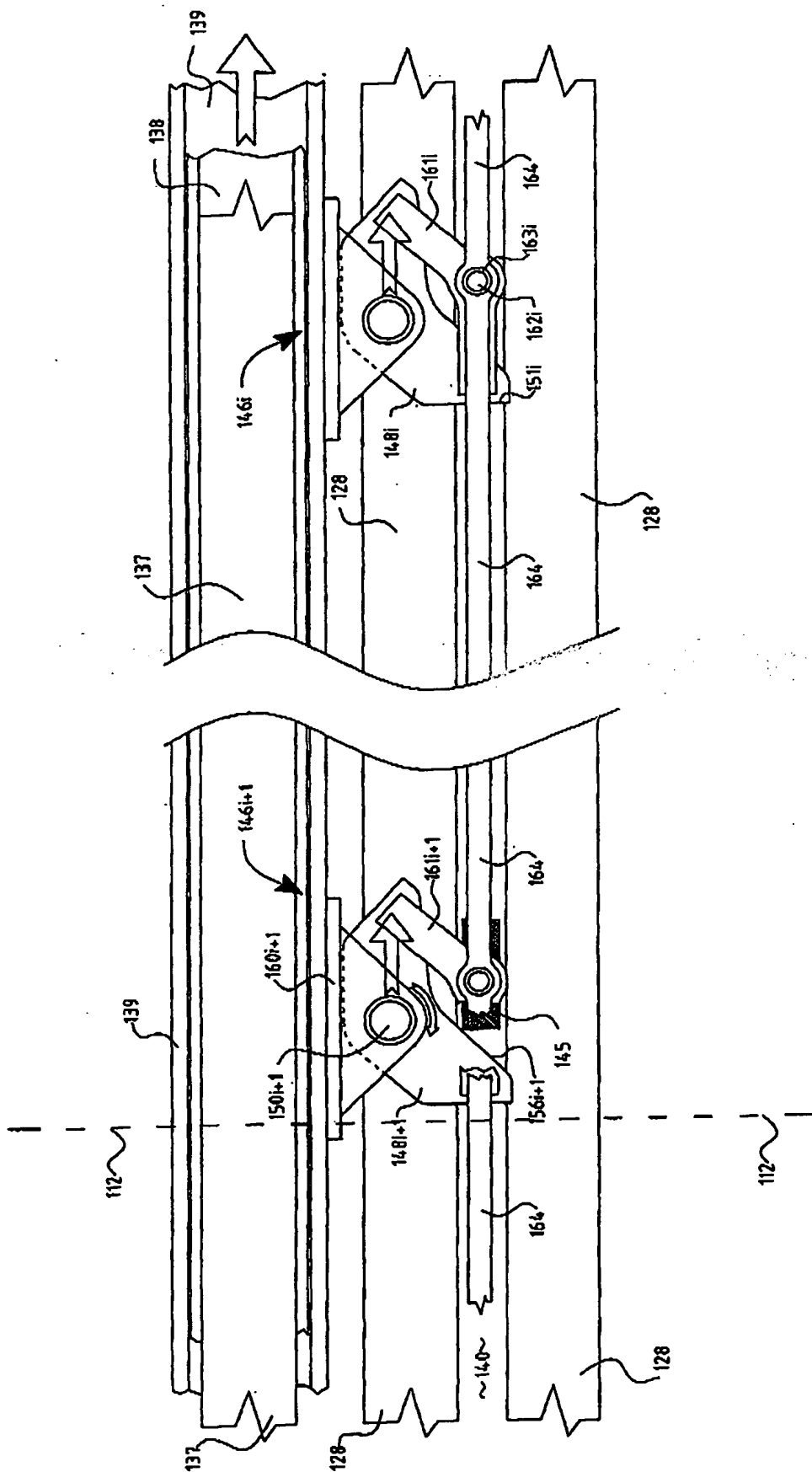


Fig. 8b

10/18

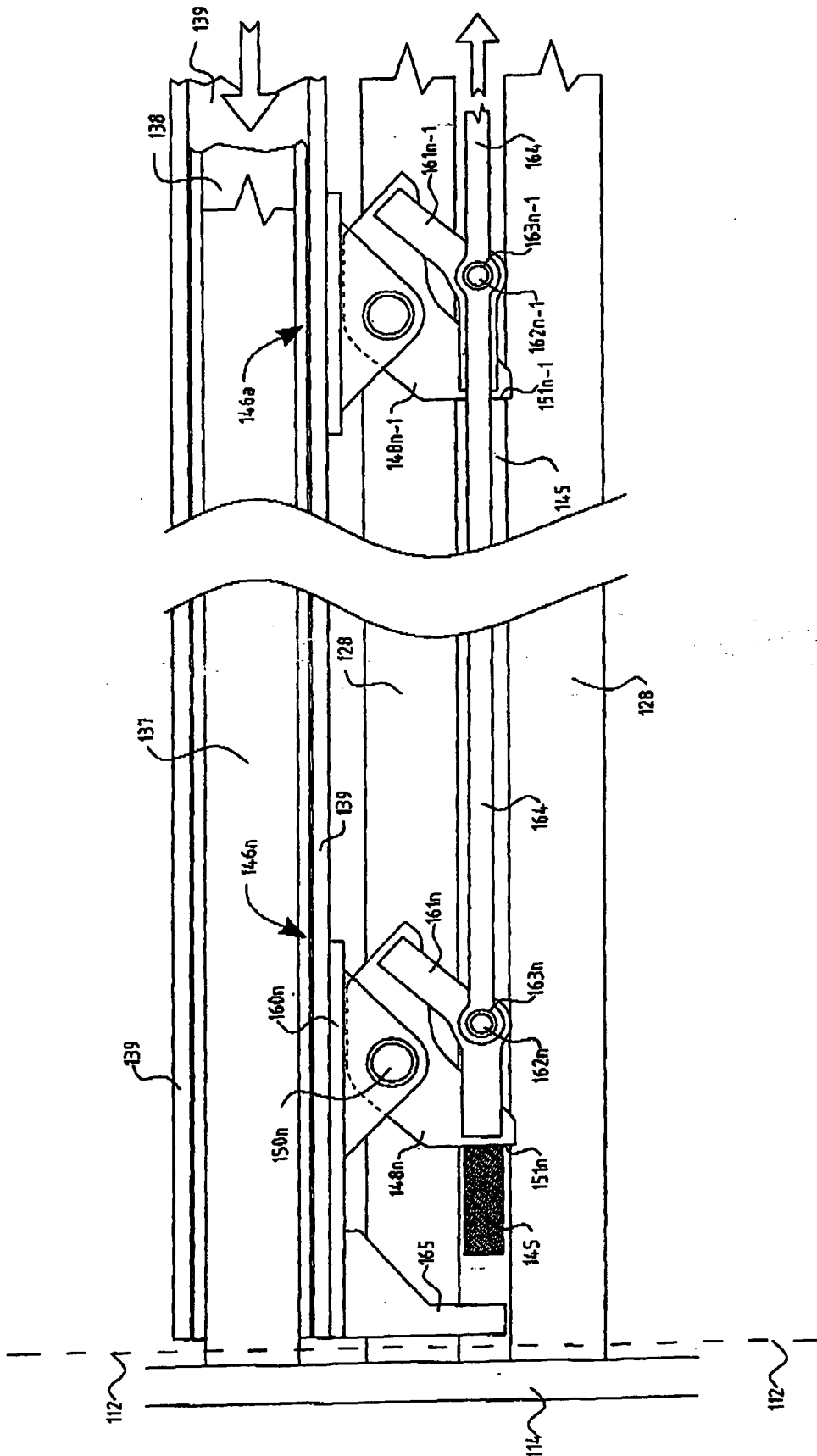


Fig. 9a

11/18

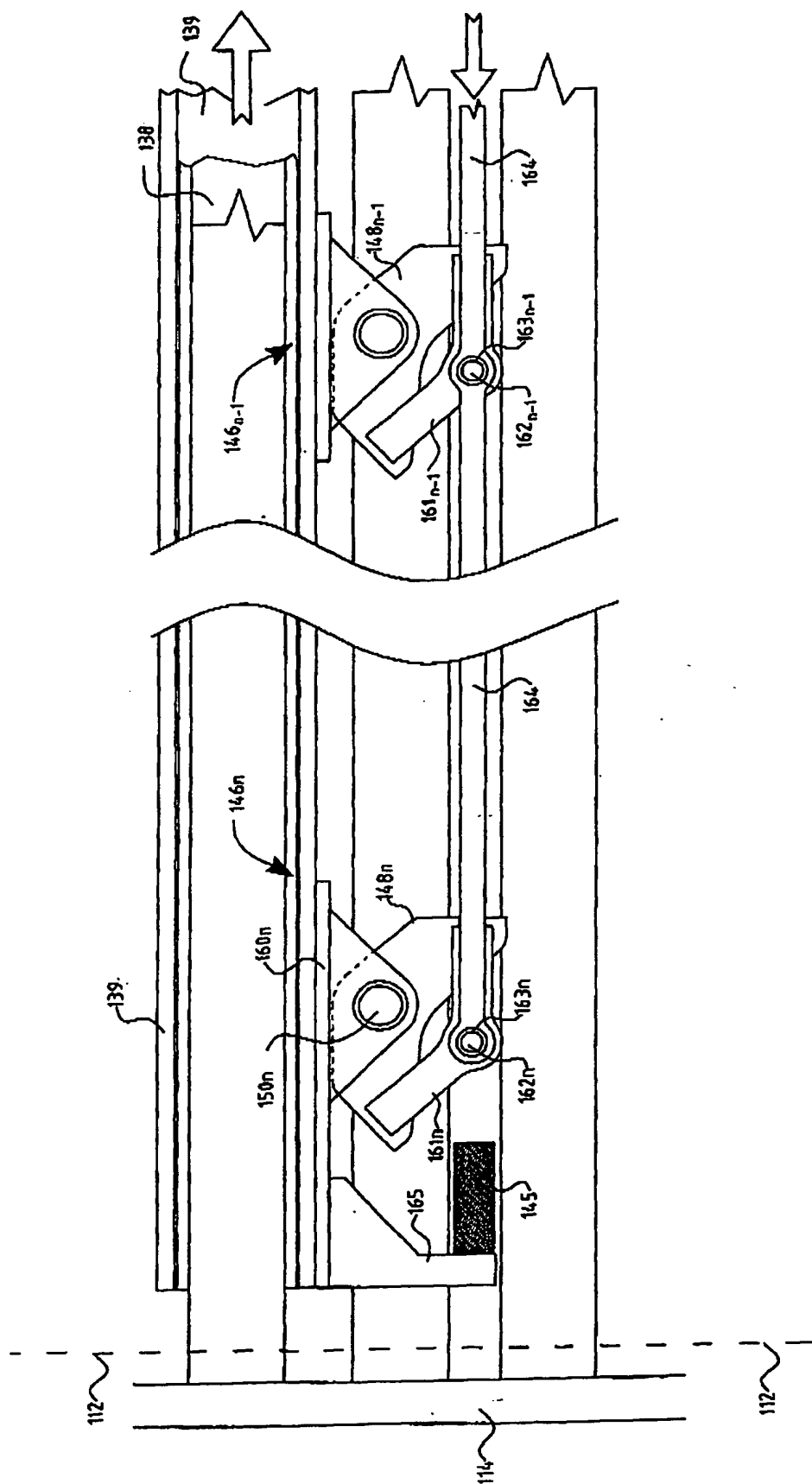


Fig. 9b

12/18

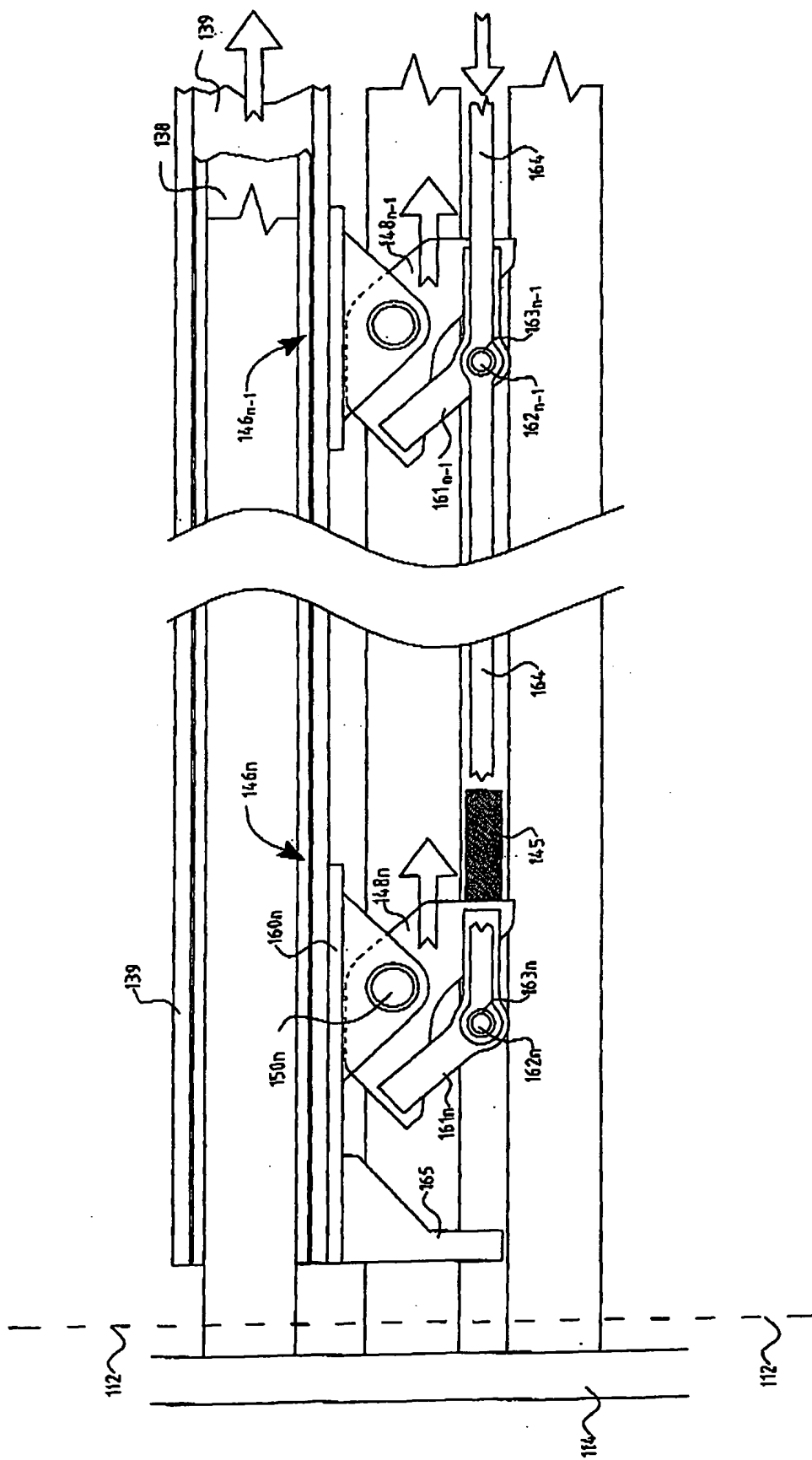


Fig. 9

13/18

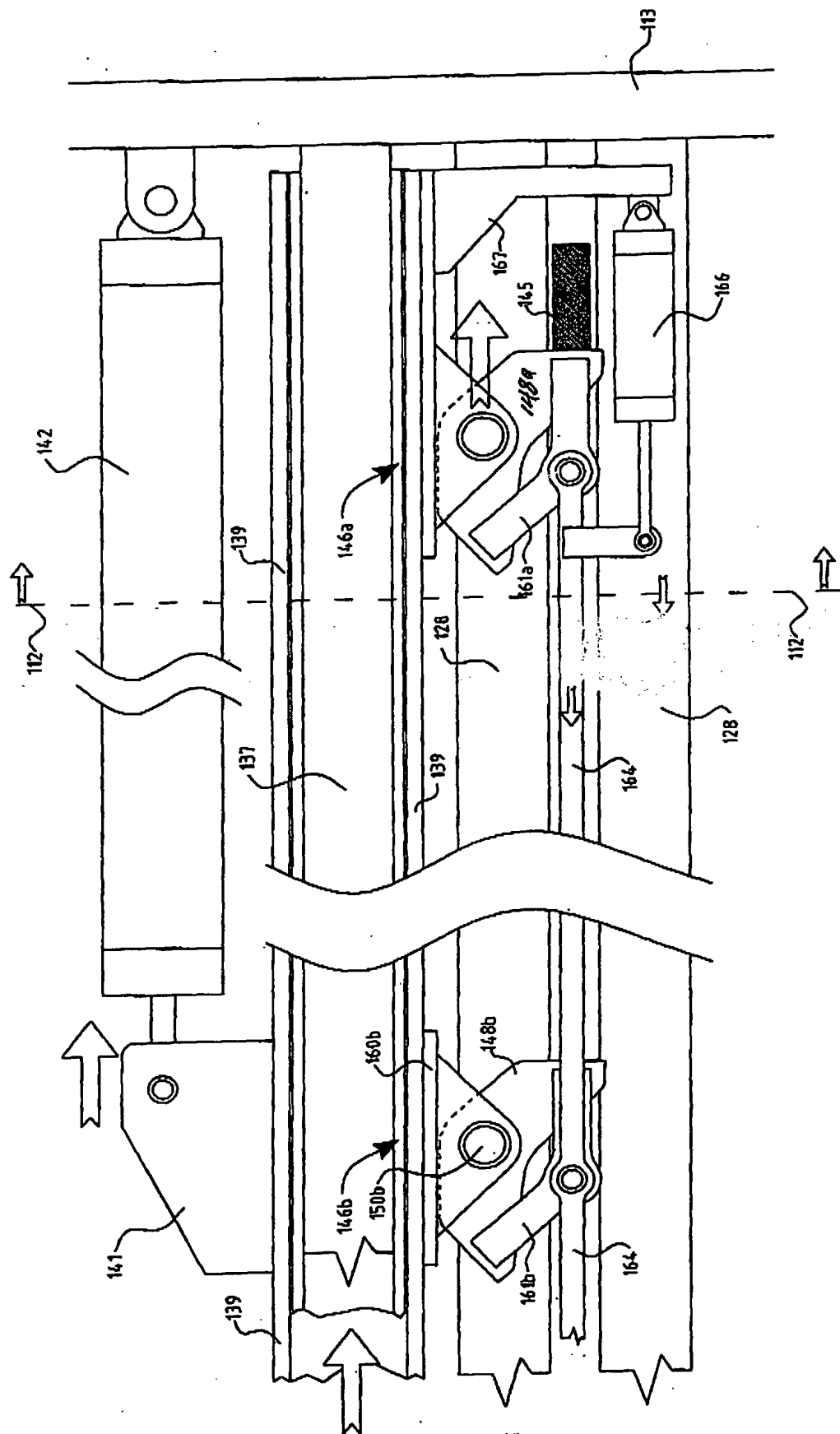


Fig. 10a

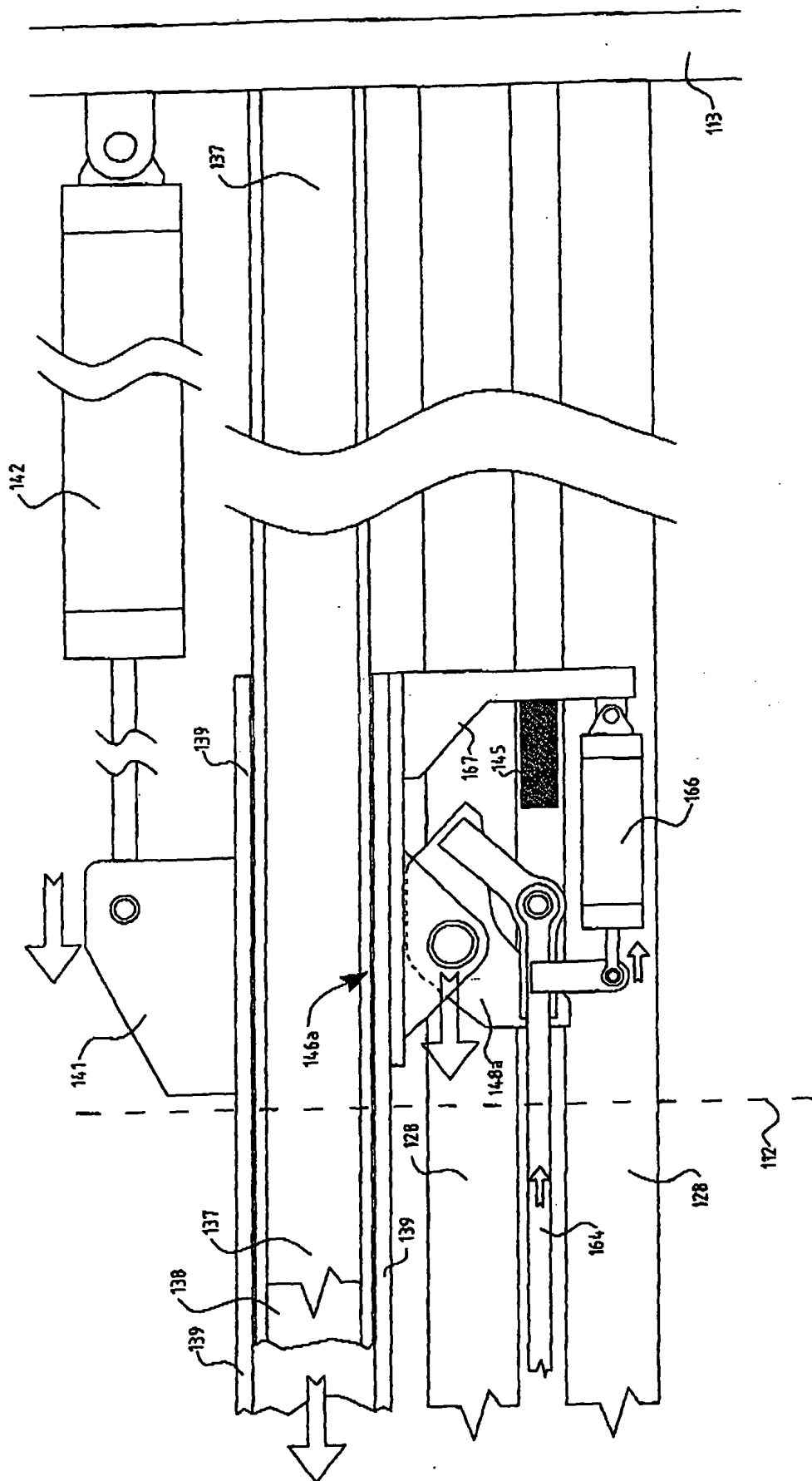


Fig. 10b

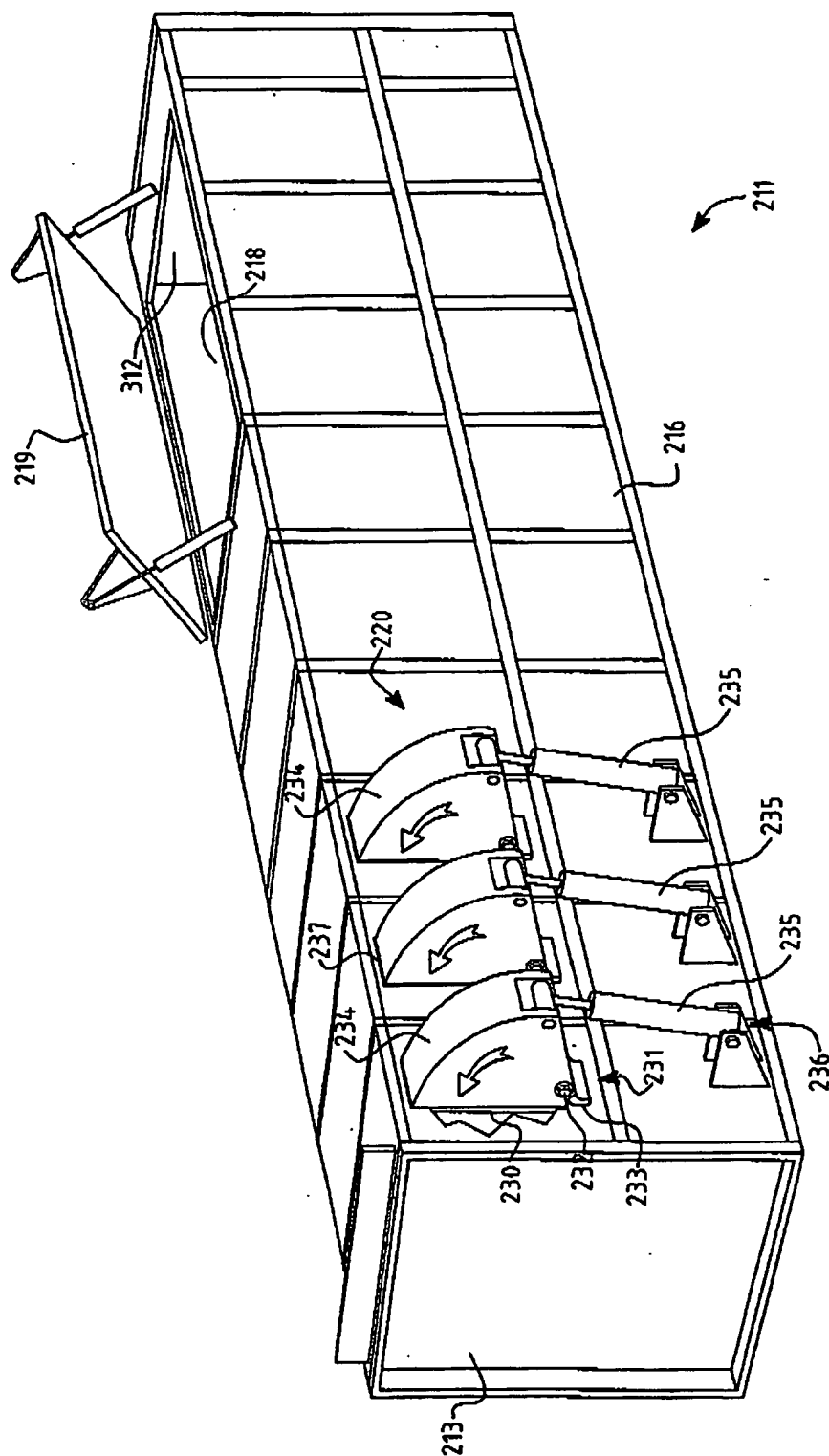


Fig. 11

16/18

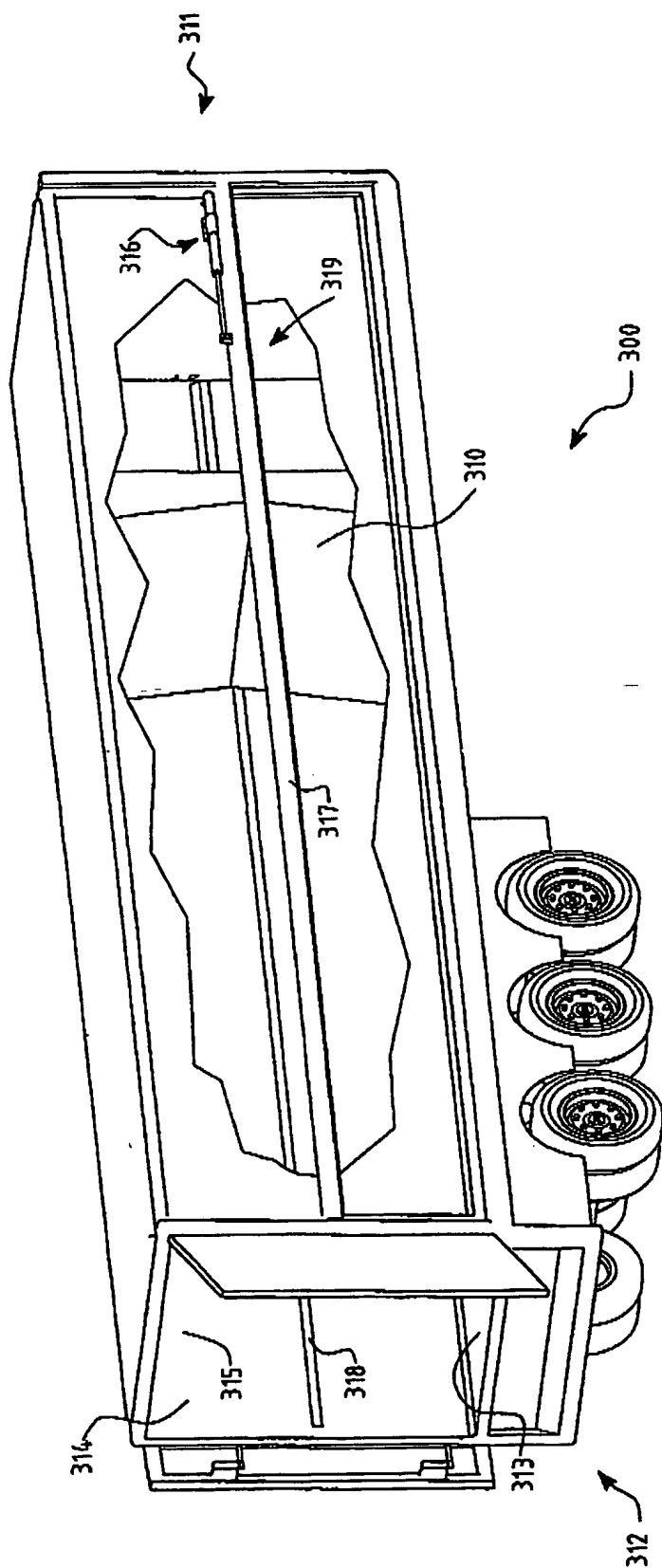


Fig. 12

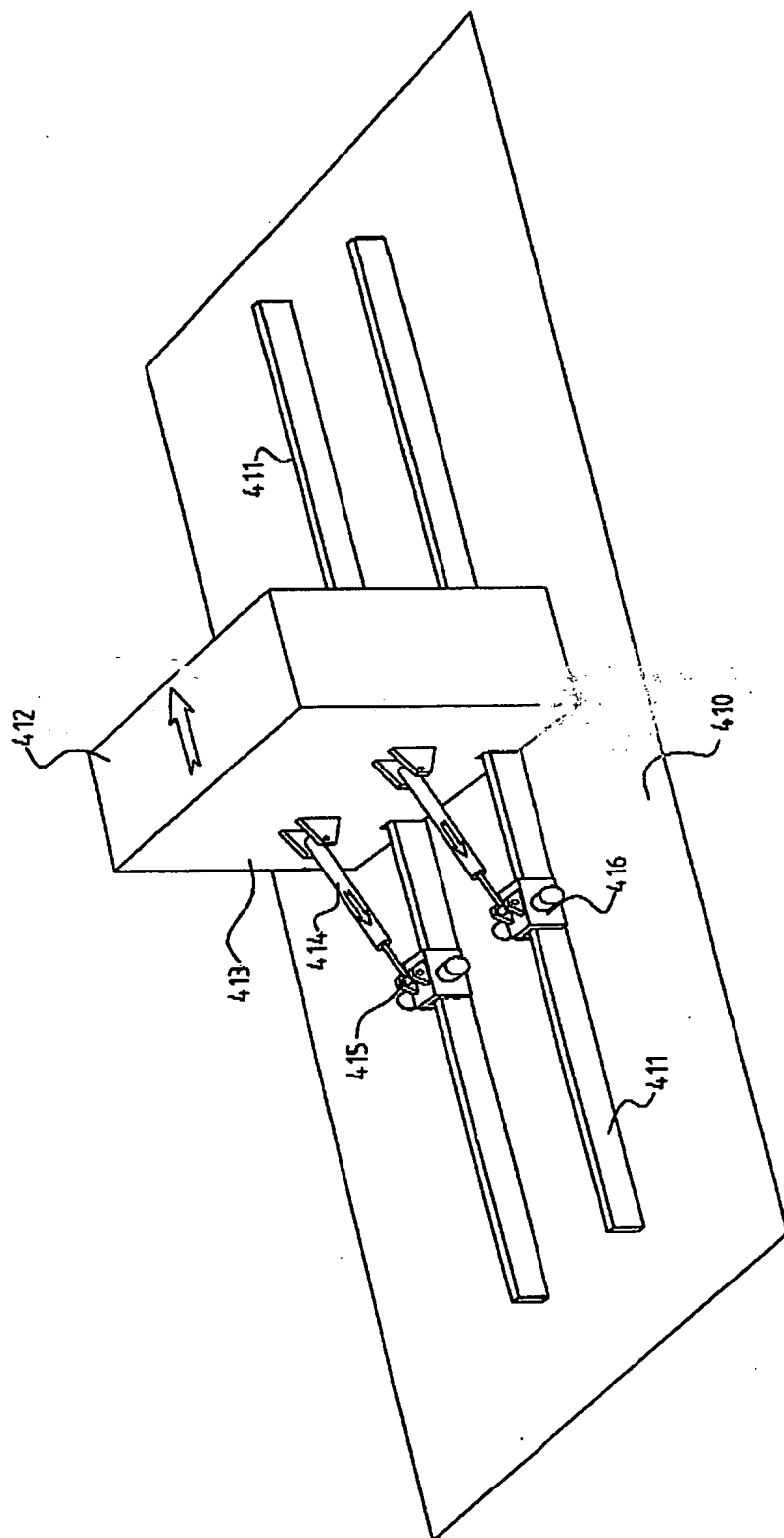


Fig. 13

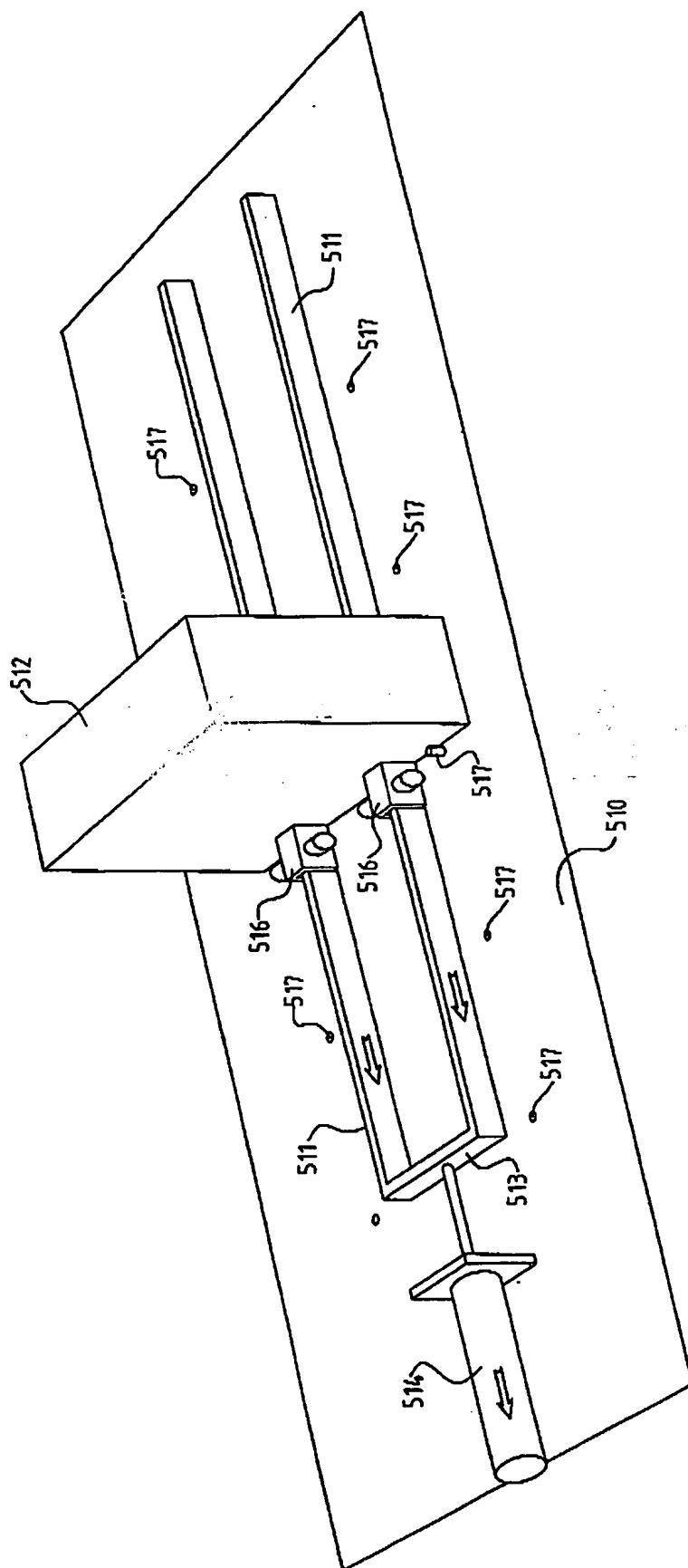


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/00349

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. ⁷ : B65G 25/08, 25/10, B65F 3/14, B65B 13/20, 63/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: B65G 25/08, 25/10, 25/IC, B65F 3/14, 3/IC, B65B 13/20, 13/IC, 63/02, 63/IC		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
AU: B65G 25/08, 25/10, B65F3/14		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPAT: (increment+ or step+ or partial+ or further) and (thrust+ or ram+ or push+ or urge+ or urging)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0562312 B1 (MARATHON EQUIPMENT COMPANY) 14 May 1997 See whole document	1, 40, 51, 57, 58
A	AU 86966/75 B (ALFRED JOHN BAKER) 8 December 1975 See whole document	1, 40, 51, 57, 58
A	AU 86966/95 B (ANTHONY PAUL AHRENS) 8 February 1996 See whole document	1, 40, 51, 57, 58
<input type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 5 May 2003		Date of mailing of the international search report 12 MAY 2003
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer BARRY STEPHENS Telephone No : (02) 6283 2106

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU03/00349

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
EP	0562313	BE	836362
AU	86966/75		NONE
AU	27213/95		NONE
END OF ANNEX			

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☒ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.